COMPARATIVE EVALUATION OF SURGICAL SITE WOUND INFILTRATION VERSUS EPIDURAL INSTILLATION OF 0.2% ROPIVACAINE FOLLOWING LUMBAR LAMINECTOMY

A THESIS SUBMITTED TO BABA FARID UNIVERSITY OF

HEALTH SCIENCES, FARIDKOT (PUNJAB)

FOR THE PARTIAL FULLFILMENT

FOR THE AWARD OF DEGREE OF

DOCTOR OF MEDICINE

IN

ANAESTHESIOLOGY

2024

Submitted By

DR. SARVESH KUMAR

DEPARTMENT OF ANAESTHESIOLOGY

DAYANAND MEDICAL COLLEGE AND HOSPITAL

LUDHIANA, PUNJAB

DECLARATION BY THE CANDIDATE

I hereby declare that the thesis entitled **"COMPARATIVE EVALUATION OF SURGICAL SITE WOUND INFILTRATION VERSUS EPIDURAL INSTILLATION OF 0.2% ROPIVACAINE FOLLOWING LUMBAR LAMINECTOMY"** submitted towards partial fulfillment of the requirements for the award of **MD IN ANAESTHESIOLOGY** degree to BFUHS is a compilation of original work carried out by me under the supervision of **Dr. Sandeep Kundra,** Professor, Department of Anaesthesiology, **Dr. Gurpreeti Kaur,** Associate Professor, Department of Anaesthesiology, **Dr. Ashwani Kumar Chaudhary,** Professor & Head, Department of Neuro-Surgery, in DMCH. No part of this thesis has formed the basis for the award of any degree previously.

_____

DR. SARVESH KUMAR

Department of Anaesthesiology

Dayanand Medical College & Hospital,

Ludhiana, Punjab

Date:

Place:

CERTIFICATE OF SUPERVISORS

This is to certify that the work incorporated in this thesis entitled **"COMPARATIVE EVALUATION OF SURGICAL SITE WOUND INFILTRATION VERSUS EPIDURAL INSTILLATION OF 0.2% ROPIVACAINE FOLLOWING LUMBAR LAMINECTOMY"** has been carried out by **Dr. Sarvesh Kumar,** under our direct supervision. The data incorporated in this thesis is original and genuine and has been carried out by the candidate himself.

Signature of Supervisor

Dr. Sandeep Kundra
Professor
Department of Anaesthesiology
DMCH, Ludhiana

Signature of Co-Supervisors

Dr. Gurpreeti Kaur
Associate Professor
Department of Anaesthesiology
DMCH, Ludhiana

Dr. Ashwani Kumar Chaudhary
Professor & Head
Department of Neuro-Surgery
DMCH, Ludhiana

Date:

ENDORSEMENT BY THE HEAD OF THE INSTITUTE

This is to certify that the thesis entitled **"COMPARATIVE EVALUATION OF SURGICAL SITE WOUND INFILTRATION VERSUS EPIDURAL INSTILLATION OF 0.2% ROPIVACAINE FOLLOWING LUMBAR LAMINECTOMY"** is a bonafide research work done by **Dr. Sarvesh Kumar** under the supervision of **Dr. Sandeep Kundra,** Professor, Department of Anaesthesiology, **Dr. Gurpreeti Kaur,** Associate Professor, Department of Anaesthesiology, **Dr. Ashwani Kumar Chaudhary,** Professor & Head, Department of Neuro-Surgery, in this institution.

Principal

Dr. G S Wander
Principal
DMC&H, Ludhiana

Date:

COPYRIGHT

Declaration by the Candidate

I hereby declare that the Baba Farid University of Heath Sciences, Faridkot, shall have the rights to preserve & use this thesis in print or electronic format for academic/study purpose by the research scholar/students.

Signature

Dr. Sarvesh Kumar
Department of Anaesthesiology
Dayanand Medical College & Hospital,
Ludhiana, Punjab

Date:

© Baba Farid University of Health Sciences, Faridkot

Dedicated

to

my Grand

Parents

ACKNOWLEDGEMENT

First and foremost, praises and thanks to almighty, for showering His blessings that helped me accomplish this work. It is my proud privilege to express my gratitude and indebtness to my esteemed teacher and elite supervisor ***Dr. Sandeep Kundra****, Professor, DMCH, for providing invaluable guidance throughout this work. His vision, sincerity and motivation have deeply inspired me. I am privileged to be associated with him as a student.*

I extend my heartfelt thanks to my esteemed Co-supervisor, ***Dr. Gurpreeti Kaur****, Associate Professor, Department of Anesthesia, DMCH for broadening my horizon and for her invaluable suggestions throughout the course of the study, which exceptionally inspired me as a student and a researcher.*

I am grateful to my Co-supervisor, ***Dr. Ashwani Kumar Chaudhary****, Professor and Head, Department of Neurosurgery, Dayanand Medical College and Hospital, Ludhiana for his cooperation and help in the completion of this work.*

I would like to acknowledge with much appreciation the role of Prof. Anju Grewal, Former Prof and Head, Department of Anaesthesia; Dr. Suneet Kant Kathuria, Prof and Head, Department of Anesthesia; Dr. Shikha Gupta, Dr. M Rupinder, Dr. Kamakshi Garg, Dr. Neeru, Dr. Udeyana Singh, Dr. Richa Jain and Dr. Tanveer Singh for their constant encouragement and support.

This dissertation would not have been possible without the guidance of several individuals who in one way or another contributed and extended their valuable assistance in preparation and completion of this study. I extend my special thanks to Dr. Purnima Bishnoi for her unconditional love, prayers and motivation throughout this journey.

I am extremely grateful to my parents Mr. Balkish Raj and Mrs. Jaswant Kaur, my uncle Dr. Harpreet Singh, my sister Dr. Karanpreet Kaur and my friend Dr. Alisha Aluna for their support and guidance for which my mere expression of thanks does not suffice. I owe my thanks to my brother-in-law Dr. Inderpreet Singh for his endless patience and support at every possible step in the course of this study.

Of course, this work would not have been possible without the participation of the patients. A special vote of thanks to my seniors and juniors for teaching me each day to become a better doctor and a better human being. I express my gratitude to all the patients for their cooperation. Finally, my sincere thanks to all the people who have supported me directly or indirectly to accomplish this endeavour by contributing in every way possible.

Dr. Sarvesh Kumar

LIST OF ABBREVIATIONS

NSAID'S	Non steroidal anti inflammatory drugs
VAS	Visual analog scales
HPS	Heft-Parker visual analog scales
NRS	Verbal rating scales
VRS	Numerical rating scale
FPS	Faces pain scale
WBS	Wong Baker faces pain rating scale
TENS	Transcutaneous electrical nerve stimulation
PCA	Patient controlled analgesia
PACU	Post anesthesia care unit
PONV	Postoperative nausea and vomiting
LSS	Lumbar spinal stenosis
CWI	Continuous wound infiltration
LIA	Local infiltration analgesia
SBP	Systolic blood pressure
DBP	Diastolic blood pressure
MAP	Mean arterial pressure
IV	Intra venous
ASA	American society of anesthesiologists
ECG	Electrocardiogram
NIBP	Non-invasive blood pressure
HR	Heart rate
SPO2	Arterial oxygen saturation
ETT	Endotracheal tube
BMI	Body mass index
MBS	Modified Bromage score
NS	Normal saline

ABSTRACT

Introduction: Surgical site wound infiltration using local anesthetic agent is a widely used and effective technique for prophylaxis of post operative pain. However, pain relief using this technique is for a limited duration. Epidural analgesia is again a widely used and effective technique for a variety of surgeries. However, epidural analgesia requires placement of catheter in the epidural space and this can be challenging in spine surgeries. In Lumbar Laminectomy surgeries, epidural space is easily accessible. Hence, local anasethetic infiltration can be directly applied on the epidural space. This inexpensive and easy to use technique can provide effective postoperative analgesia.

Aim of Study: To compare the efficacy of epidural infiltration of 10ml of 0.2% ropivacaine with sub-cutaneous wound infiltration of 10ml 0.2% ropivacaine for post operative pain relief following lumbar laminectomy.

Materials & methods: 60 adult patients aged 18-65 belonging to ASA I, II and III scheduled for lumbar laminectomy under general anesthesia will be randomly allocated to two groups of 30 patients each using a computer-generated table of random numbers. Group A patients will be administered sub-cutaneous wound infiltration of 10ml 0.2% ropivacaine. Group B patients will be administered epidural instillation of 10ml 0.2% ropivacaine. Post operatively, patients will be shifted to the PACU, where monitoring of HR, NIBP, RR and SpO2 and recording of VAS/NRS would be done every hourly for first initial 4 hours and after that every 4 hourly till the initial 24 hours. Any patient complaining of pain or NRS >4, will be administered Inj morphine 5mg. Duration of analgesia and total morphine consumption in 24 hours will be recorded.

Clinical Significance: This study will help to assess the safety and efficacy of direct epidural instillation of local anesthetic solution for management of pain following lumbar laminectomy.

Results: The patients in both the groups were comparable with respect to age, gender, weight, height, BMI and ASA physical status. The mean HR, SBP, DBP and MAP values after administration of study drug were comparable in majority of the time periods among group A and B. The respiratory rate and mean oxygen saturation after administration of study drug were comparable in both the groups. The MBS score at 0 hour after shifting to PACU was statistically insignificant in both the groups A and B. It remained insignificant throughout the stay of the patient in PACU for first 24 hours. The incidence of pain was significantly lesser in group B as compared to group A. On intergroup comparison, mean numerical rating score was significantly lower in group B as compared to group A at 12, 16, 20 and 24 hour. Consumption of the rescue analgesic used in the form of morphine was higher in group A in comparison to group B. In group A, mean morphine consumption was 10.33 mg, whereas, in group B it was 5.00 mg. This value was statistically significant showing mean morphine consumption in group B to be significantly lower as compared to group A.

Conclusion: It is concluded that pain scores and requirement of rescue analgesia in the form of morphine is less required in group B (epidural instillation of 0.2% ropivacaine) following lumbar laminectomy in comparison to group A (local wound infiltration of 0.2% ropivacaine).

Keywords: Ropivacaine, wound infiltration, epidural instillation, Post operative pain.

TABLE OF CONTENTS

S.NO.	TOPIC	PAGES
I	INTRODUCTION	1-3
II	AIMS AND OBJECTIVES	4
III	REVIEW OF LITERATURE	5-19
IV	MATERIALS AND METHODS	20-23
V	OBSERVATIONS AND RESULTS	24-43
VI	DISCUSSION	44-53
VII	SUMMARY AND CONCLUSIONS	54-56
VIII	BIBLIOGRAPHY	57-64

APPENDICES–I

- PROFORMA
- MASTER CHART

APPENDICES–II

- APPROVAL LETTER OF THESIS PLAN
- THESIS PLAN

LIST OF TABLES

TABLE NO.	TITLE	PAGE NO.
1	Mean Age distribution	25
2	Gender distribution	26
3	Mean weight	27
4	Mean height	28
5	Mean BMI	29
6	Diagnosis of cases of group A and B	30
7	ASA physical status	31
8	Mean heart rate after administration of study drug	32
9	Mean systolic blood pressure after shifting to PACU	33
10	Mean diastolic blood pressure after shifting to PACU	34
11	Mean Arterial Pressure after administration of study drug	35
12	Respiratory rate after administration of study drug	36
13	Mean oxygen saturation (SpO_2) after administration of study drug	37
14	Numerical rating score after shifting to PACU	38
15	Administration of rescue analgesic in PACU	39
16	Modified Bromage score after shifting to PACU	40
17	Mean Morphine Consumption After Shifting To Pacu	42
18	Adverse Events After Shifting To Pacu	43

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE NO.
1	CONSORT flow diagram of the study	24
2	Mean Age distribution	25
3	Gender distribution	26
4	Mean weight	27
5	Mean height	28
6	Mean BMI	29
7	Diagnosis of cases of group A and B	30
8	ASA physical status	31
9	Mean heart rate after administration of study drug	32
10	Mean systolic blood pressure after shifting to PACU	33
11	Mean diastolic blood pressure after shifting to PACU	34
12	Mean Arterial Pressure after administration of study	35
13	Mean respiratory rate after administration of study drug	36
14	Mean oxygen saturation (SpO_2) after administration of study drug	37
15	Numerical rating score after shifting to PACU	38
16	Modified Bromage score after shifting to PACU	41
17	Mean morphine consumption after shifting to PACU	42

BABA FARID UNIVERSITY OF HEALTH SCIENCES
Sadiq Road, Faridkot-151203 (Pb.) INDIA
Phone No. 91-1639-256253 and Fax No. 91-1639-256234
Website: www.bfuhs.ac.in, Email: bfuhspc@gmail.com

(BFUHS – UNIVERSITY LIBRARY- Coordinator APC)

11-BFUHS (LI-PC-134)24/834 Dated: July 13, 2024

Plagiarism Verification Certificate

Title of the thesis: **Comparative evaluation of surgical site wound infiltration versus epidural instillation of 0.2% ropivacaine following lumbar laminectomy**

Total Page: **61 (Sixty One only) eFSPC (eFile Sent for Plagiarism Check)**

Researcher: **Sarvesh Kumar**

Supervisor: **Dr. Sandeep Kundra**

Research Centre: **Dayanand Medical College and Hospital, Ludhiana**

This is to report that the above thesis was scanned for similarity detection. Process and outcome is given below:

DID:	**2109549**	Software used:	**DRILLBIT**
Date:	**July 13, 2024**	Similarity Index:	**9% (Below 10 Percent)**

Total words count: **12786 (eFSPC)**

The complete report is submitted for review by the Supervisor.

University Coordinator/
Name & Signature (Checked by)
(From University library)

The complete report of the above thesis has been reviewed by the undersigned. (Check Box)

☐ The similarity index is below accepted norms.

☐ The similarity index is above accepted norms, because of the following reasons:

1.....
2.....
3…….....
4…….....
5……

The thesis may be considered for the award of degree. (Relevant documents attached).

Research Scholar **Supervisor**

INTRODUCTION

Laminectomy is a surgical procedure that involves tissue disruption, including soft tissue and muscle dissection, manipulation and removal at the operative site. One of the main indications for laminectomy is degenerative spine disease. With increasing life expectancy and sedentary life style, the incidence of diseases afflicting spine are increasing. Many of these patients need surgery of spine at some stage. The majority of patients undergoing spine surgery experience severe pain during the initial 12 hour post operative period. This pain persists both at rest and during mobilization.[1]

It is extremely important to institute an effective strategy to counter post-operative pain following laminectomy. Uncontrolled pain can precipitate a cascade of adverse sequelae, including sympathetic nervous system activation, manifesting as elevated blood pressure and heart rate, potentially culminating in cardiovascular compromise.[2] This can also delay patient mobilization and cause dissatisfaction to the patient and relatives. In fact, postoperative pain is one of the chief concerns for patients undergoing surgical procedures. [3]

A range of postoperative analgesic options are available, comprising intravenous opioids, non steroidal anti-inflammatory drugs (NSAIDS), alpha-2 agonists, anti-depressants, intrathecal administration of opioids and local anesthetics. [4] Opioids effectively alleviate pain but its use is often accompanied by various adverse effects , including opioid induced hyperalgesia , tolerance and respiratory depression which can lead to prolonged hospital stay. [5]

Despite the advancements in availability of many drugs, still 30-80% of postoperative patients are reported to experience truly moderate to severe pain on the first post-operative day. [4] This may be due to reluctance on that part of anesthesiologists to the use of opioids, fearing their adverse effects. As a result, alternative approaches have

been sought to minimize opioid usage with a focus on various loco-regional techniques.

The infiltration of local anesthetic drugs into wounds has emerged as a popular choice in post-operative pain management due to its safety profile, ease of administration and cost effectiveness. [6,7] Numerous studies have consistently demonstrated that ropivacaine wound infiltration significantly reduces postoperative pain and analgesic requirement. [5] A tour facility, subcutaneous wound infiltration with ropivacaine is frequently performed following surgery. Ropivacaine is preferred over bupivacaine due to its lower likelihood of motor blockade and cardiotoxicity at equivalent doses, making it a safer choice. [8,9,10]

A single subcutaneous injection of a local anesthetic has the drawback of having a short half-life. In an effort to overcome this disadvantage, some researchers have attempted continuous irrigation of surgical wound with local anesthetics using catheters inserted into it. However, this carries the drawbacks of increased cost, risk of catheter displacement, infection, and potential systemic local anesthetic toxicity. [11,12]

Epidural analgesia is also a well-established technique with good efficacy and reasonable safety profile. [13] Many researchers have deployed placement of epidural catheters following spine surgeries. However, the placement of an epidural catheter in spine surgeries carries inherent risks, including infection and potential disruption of surgical exposure. [14,15] Samagh et al found that a single caudal epidural injection using 0.2% ropivacaine placed at the end of surgery to be effective following spine surgery. [11]

During laminectomy, the epidural space is visible and easily accessible. This situation allows surgeons to apply an epidural bolus of local analgesics, potentially providing a safe and effective method for pain relief. In fact, epidural administration of multiple analgesics like opioids and steroids have been employed successfully. [16]

Therefore, we planned a comparative study to evaluate the effectiveness of epidural instillation of 10 ml of 0.2 % ropivacaine and

compare it with wound infiltration in patients undergoing lumbar laminectomy.

AIMS AND OBJECTIVE

To compare the efficacy of epidural infiltration of 10 ml of 0.2 % ropivacaine with sub-cutaneous wound infiltration of 10 ml 0.2 % ropivacaine for post operative pain relief following lumbar laminectomy in terms of:

- Rescue analgesic consumption in 24 hours
- Post operative pain scores as assessed by NRS

REVIEW OF LITERATURE

Postoperative pain is still a major concern for patients and a difficult task for medical professionals such as anesthesiologists. Despite improvements in regional anesthesia, the use of continuous analgesic infusions postoperatively, and the application of multimodal analgesic treatments, many small subsets of patients will continue to have chronic postoperative pain in the next twenty years. The onset and persistence of pain following surgery are partly caused by sensitization of the peripheral and central pain pathways. To comprehend the advantages of preventive analgesia in terms of pain reduction prior to, during, and following a detrimental insult, attenuation of pain processing in both peripheral and central neurons is required. [17,18]

An essential part of perioperative patient care is the management of acute postoperative pain. After surgery, effective pain management is crucial to a smooth recovery process overall, increased patient satisfaction, and lower medical costs. Effective management of postoperative pain is likely to reduce morbidity and enhance functional result. There is also a greater need to control perioperative pain since significant acute postoperative pain is associated with a higher likelihood of chronic postsurgical pain. [18,19]

It's crucial to comprehend the overall pathophysiology of pain before learning how different anesthetics work to control postoperative pain. According to traditional theories, the pain pathway is a chain of three neurons that runs from the cerebral cortex to the periphery. The dorsal root ganglion houses the first-order neuron's cell body. Its two axons run centrally to the spinal cord's dorsal horn, while the other projects distally to the tissue it innervates. This axon connects to the second-order neuron in the dorsal horn; the neuron's axon exits the spinal cord via the anterior horn. [20,21]

It is believed that the discriminative (or "first pain") and affective-motivational (or "second pain") components of pain are transported independently by the central nervous system at the time of pain perception. The brain stem, thalamus, and cortex are the three main regions from which descending pathways arise, and they can affect

activities at the spinal level in addition to the spinal control mechanisms of nociceptive transmission. There is a strong link between visceral and somatic pain pathways at every level of the neurological system. This connection most likely explains how visceral pain spreads, as well as how the body reacts somatically and autonomically to visceral pain. [20,22]

Furthermore, postoperative pain might be classified as visceral or somatic. The rich input of nociceptive myelinated, fast conducting A-beta-fibers found in cutaneous and deep tissue, which contribute to a more localized, sharp quality, makes up the somatic division of pain. A network of sparsely myelinated A-delta fibers and unmyelinated C-fibers that cross several viscera and merge before entering the spinal cord make up the visceral division of pain. [23] Additionally, before entering the dorsal root of the spinal cord, visceral afferent fibers pass near autonomic ganglia. Visceral nociceptive fibers' distinctive characteristics are what cause a more widespread, poorly localized pattern of pain, which may be accompanied by autonomic responses such an alteration in blood pressure or heart rate. [24]

Reduce the indiscreet effects of immediate postsurgical pain and assist the patient in smoothly returning to normal function are the goals of postoperative pain management. Historically, the cornerstone of care for acute postoperative pain has been opioid analgesic medication. The overuse of opioids, which has raised rates of morbidity and death, has raised demands for the development of multimodal pain treatment solutions. [25]

To get enough pain relief following surgery, proper documentation of pain management and ongoing pain assessment are crucial. In addition to offering a crucial channel of communication between doctors and patients, documentation can help maintain continuity of care. [26] Regular documentation helps assessments of the quality of care and offers legal proof of the caring process. Typically, a pain scale is used to complete the assessment of pain severity. [27] During the postoperative phase, acute pain is typically assessed with unidimensional pain scales. [28] When dealing with acute pain, there are

several ways to assess if pain management is sufficient: [23,28,29] We'll talk about a few of them here.

- Visual analog scales (VAS)
- Heft-Parker visual analog scale (HPS)
- Verbal rating scale (VRS)
- Numerical rating scale (NRS)
- Faces pain scale (FPS)
- Wong-Baker faces pain rating scale (WBS)

The most widely used tool for assessing pain following surgery is the Visual Analogue tool (VAS). With word descriptions of pain at either end of the scale—0 denoting "no pain" and 10 denoting the "worst possible pain"—this pain scale uses a metered line marked from 0 to 10. We are recording the participants' pain levels in our study using the NRS (numerical rating scale). The NRS is sensitive to pain-related treatments and has a well-established validity. It also correlates favorably with other measures of pain. This measuring scale was used to classify the severity of pain.

- No pain: level of 0 on the numerical pain scale.
- Mild Pain: level of pain on a numerical pain scale between 1 and 3.
- Moderate pain: level of pain on the numerical pain scale between 4 and 6.
- Severe Pain: level of pain on the numerical pain scale ranging from 7 to 10. [28,30]

When assessing acute pain following surgery, the widely used visual analogue scale (VAS) and numeric rating scale (NRS) exhibit good agreement, equal sensitivity, and superiority over a four-point verbal categorical rating scale (VRS). Both are most effective when it comes to the patient's subjective perception of their current pain level. They can be applied to the most, least, or average pain experienced in the previous day or week. [31]

It was demonstrated that a significant difference increased the power to detect a change in pain intensity. An NRS, which uses values ranging

from 0 to 10 (meaning "no pain" to "worst pain imaginable") is more widely used than a VAS, easier for most people to understand, and doesn't require paper, a pen, clear vision, or dexterity. Even more precise methods for assessing pain intensity include telephone interviews, computerized telephone interviews, and direct patient entry of NRS data using a phone keyboard into a computer database. It has been demonstrated that the NRS and the VAS provide the same results in the same patient at different points following surgery, however the four-point VRS appeared to underestimate the most severe pain in comparison to the NRS and VAS. [32]

For the purpose of minimizing and controlling postoperative pain, numerous preoperative, intraoperative, and postoperative treatments and management techniques are available. The American Society of Regional Anesthesia and Pain Medicine evaluated and accepted a practice guideline for acute pain management in the perioperative period that the American Society of Anesthesia and Pain Medicine released in 2012. The following are some of the therapeutic techniques used for postsurgical patients' multimodal pain management: [23,33]

1. Systemic Pharmacologic Therapy: Opioids, NSAIDs and/or acetaminophen, steroids, gabapentin or pregabalin, IV ketamine, and IV lidocaine are often used drugs for postoperative pain control. Opioids should be administered orally rather than intravenously. It is not advised to use intramuscular medicines. However, in some situations where there is a risk of aspiration and paralytic ileus, parenteral medicine administration is required, and intravenous patient-controlled analgesia (PCA) is advised whenever possible. [23,33]

2. Local, Intra-articular, or Topical Techniques: For site-specific pain management, anesthetic wound infiltration, topical anesthetics, peripheral nerve blocks, and intra-articular anesthetic injections can be utilized. These techniques are not frequently applied. Beneficial evidence should be the basis for considering their administration. [34]

3. Regional anesthetic techniques: Depending on the type of surgery performed, a local anesthetic with or without the addition of IV opioid medication is an option for fascial plane block, site-specific regional anesthetic injections, or in some circumstances epidural injections. When surgical pain lasts for an extended period of time, continuous intravenous medicine is preferred to single-injection methods. Due to the lack of data supporting its usefulness and the high systemic absorption of drugs within the pleural space, which raises the risk of drug toxicity, intrathecal analgesia is not advised for the treatment of pain. [35]

4. Neuraxial anesthetic techniques: An epidural injection of local anesthetic, either alone or in combination with IV opioid medicine, is used in this anesthesia delivery technique. The intrathecal (spinal) injection of opioid medications may also fall under this category. Both patient-controlled and continuous infusion forms of epidural analgesia are available. These methods are commonly used in major abdominal and thoracic procedures, hip or lower extremity surgeries, and cesarean sections. Patients who are at risk for cardiac or pulmonary problems, or prolonged ileus, benefit most from these treatments. [23] According to certain research, individuals undergoing lumbar spine surgery should be given neuraxial anesthesia rather than general anesthetic. A 2018 meta-analysis found that when spinal anesthesia is used instead of general anesthesia for lumbar spine surgery, there is a decreased risk of intra-operative hypertension and tachycardia, a decrease in the need for analgesics in the PACU, and a decrease in side effects like postoperative nausea and vomiting (PONV) after 24 hours. [36]

5. **Nonpharmacologic therapies:** Examples of nonpharmacologic pain management techniques include mechanical techniques like transcutaneous electrical nerve stimulation (TENS) or cognitive techniques.

Approximately 10% of the population is affected by lumbar stenosis, which is on the rise these days. These days, the most frequent spinal issues are those that arise. Anatomical narrowing of the intraspinal canal and lateral recesses, combined with compression of the neural components by the soft tissue and bone, is referred to as lumbar stenosis. One can have congenital or acquired lumbar stenosis. Skeletal disorders, degeneration, trauma, and space-occupying lesions are among the possible causes of acquired spondylosis.

Achondroplastic dwarfism, whose trapezoid vertebrae result in shortened pedicles and a constricted spinal cord, is one of the congenital causes of lumbar spinal stenosis (LSS). [26] The primary course of treatment for both kinds of lumbar spinal stenosis is still lumbar laminectomy. Surgical success rates are relatively high when conducted on patients who present with distinctive clinical characteristics such as neurogenic claudication, radiculopathy, or both. A lumbar laminectomy treatment results in 93% pain alleviation and 95% restoration to normal activity level, according to a study. As more lumbar laminectomy procedures are being done as outpatient procedures, effective pain management is essential to preventing readmission and post-operative delays in discharge. [26,27]

A variety of medications and methods have been used to treat pain after lumbar laminectomy. The mainstays of post-operative pain therapy have been nonsteroidal anti-inflammatory medications (NSAIDs) and opioids; nevertheless, both have been linked to a number of negative effects. The goal of multi-modal analgesia is to minimize side effects associated with specific medications by utilizing a variety of analgesic medicines and regional analgesic approaches. [36] Local anesthetic infiltration of the incision site wound has proven to be an effective multimodal pain management strategy. Local anesthetic infusion into wounds continually penetrates peripheral nerve endings and reduces pain by directly obstructing sodium channels in neuronal membranes. [37]

Rapid onset of a dependable block that provides sufficient surgical anesthesia of an appropriate duration, quick recovery of sensory and motor block, and minimal side effects are the key components of an excellent anesthetic drug. Local anesthetics such as lignocaine, bupivacaine, levobupivacaine, and ropivacaine are available for use during surgical procedures. Lignocaine is associated with a relatively high frequency of transitory neurological effects, despite its block and recovery properties making it excellent for day surgery. Levobupivacaine and buprevacaine both have long-lasting blocking effects. Therefore, ropivacaine might be the most appropriate for this use. [36,37]

Ropivacaine is the pure S(−) enantiomer of propivacaine, a long-acting amide local anesthetic medication. Since it is less likely to cause cardiotoxicity and neurotoxicity than racemic preparations like bupivacaine, it is safer. [12] Because ropivacaine is less soluble in lipids than bupivacaine, it penetrates myelinated motor neurons less deeply and causes less motor blockage while increasing sensory motor differentiation. Ropivacaine has several uses, including intra-articular administration, caudal block, spinal anesthesia, peripheral nerve blocks, local infiltration, and epidural anesthesia and analgesia. When used in low dosages, for example, for spinal anesthesia or epidural analgesia, it is less effective than bupivacaine. But when these drugs are given in large amounts, like in peripheral nerve blocks, their effectiveness and potency become apparent. [38]

Since ropivacaine is only available on the market in isobaric formulation, dextrose must be added in order to prepare hyperbaric solutions when needed. A word of caution is necessary because there is a chance of infection from the native dextrose mixture. [39] Over the last ten years, localized analgesia has become the predominant method for managing pain following surgery. Recently, as part of multimodal analgesia for postoperative pain control following various surgical procedures under general or regional anesthesia,

single wound infiltration with local anesthetic (WI) or continuous local anesthetic infusion through catheters placed into the surgical wound (continuous wound infiltration, CWI) have been introduced. [17]

For little incisions, wound infiltration is frequently carried out under well watched anesthetic care. Recently, single wound infiltration with local anesthetic or continuous wound infiltration (CWI), in which local anesthetic is continuously infused into the surgical wound through catheters, have been reinstated as essential components of multimodal analgesia schemes for postoperative pain control after a variety of surgical procedures performed under general or regional anesthesia.[37] CWI has an opioid-sparing effect and enhances the quality of postoperative analgesia. The administration of a "high volume of diluted, long-acting local anesthetic" in tissue structures (often during knee or hip surgery) to produce analgesia is referred to as "local infiltration analgesia" (LIA). [40]

Greater volumes of the medication must be injected subcutaneously and into additional planes for larger incisions, such as those made during hysterectomy, caesarean sections, abdominal surgeries, hip and knee replacements, breast surgeries, laparoscopic procedures, cardiac procedures, thoracic surgeries, bariatric procedures, and so forth. In addition to its anti-nociceptive properties, subcutaneous local anesthesia exhibits bacteriostatic and antibacterial properties.[41] Numerous studies have demonstrated that ropivacaine wound infiltration can significantly lessen postoperative pain, lessen the need for additional analgesics, and shorten hospital stays after procedures like hip replacement, abdominal surgeries, and cesarean sections. [42]

Many benefits come with regional treatments, including the ability to treat pain at or near the site of damage to tissue and, when combined with local anesthetics, the ability to give analgesia and significantly lessen the need for opioids. The majority of these methods are constrained by potentially high failure rates, labor-intensive and technically demanding procedures, negative or toxic side effects, and difficulties related to the process itself. Although wound site infiltration

is a successful technique for treating acute post-operative pain, there isa theoretical risk of wound site infection. [41,42]

Studies on the role of wound instillation of different anesthetics in postoperative pain management have been conducted in previous years.

In a 2016 study, Altuntas et al. contrasted intraperitoneal instillation with local anesthetic infiltration at the trocar insertion sites. They concluded that infiltration of local anesthetic at the trocar site was simple, effective in providing postoperative analgesia, and a procedure with minimal morphine use and side effect frequencies. It is also possible that the patients' suffering was mostly incisional–parietal pain.[43]

In order to assess the function of local wound infiltration for infiltration anesthesia in breast cancer surgery, Vigneau et al. carried out a randomized controlled trial in 2011. During the first several hours after surgery, ropivacaine infusion via a single shot effectively controlled pain; however, there was no further benefit. [44]

In a 2005 double-blind research, Kakagia et al. used ropivacaine in one ear and bupivacaine in the other ear for surgical site infiltration during bilateral otoplasties. They observed similarities in the pain ratings during the 2h, 6h, and 10 hour postoperative periods as well as throughout the surgical procedure. As a successful substitute for bupivacaine, they suggested ropivacaine. They also examined the duration and quality of ropivacaine and bupivacaine infiltration in their investigation, with ropivacaine proving to be superior. [45]

In 2003, Fayman et al. conducted a comparison analysis between bupivacaine and ropivacaine and discovered that there was no significant difference in overall analgesia between the two infiltrations.They suggested using ropivacaine, which is thought to be

less cardiotoxic than bupivacaine, for high-dose infiltration breast analgesia. After surgery, VAS pain scores were analyzed one, two, six, and ten hours later. [46] In the current study, several parameters were analyzed at 0, 1, 2, 4, 8, 12, 16, 20, and 24 hours, including NRS, heart rate, SBP, and DBP.

According to a 2017 study by Bindra et al. on the intraperitoneal use of ropivacaine in cholecystectomy, patients who received the drug intraperitoneally prior to the formation of pneumoperitoneum required much less analgesics overall than patients who received normal saline.[47]

Hernández-Palazón et al. conducted a study in 2001 comparing the infiltration of bupivacaine and ropivacaine in lumbar disc repair. The study found that the analgesic time was significantly longer in the bupivacaine group compared to the ropivacaine or control group (164 ± 53 min vs. 68 ± 31 and 38 ± 14 min, respectively). The infusion of 0.25% bupivacaine and 0.25% ropivacaine into the paraspinal muscle and skin prior to wound closure following lumbar laminectomy. After shoulder surgery, iliac crest bone grafting, and spinal instrumentation, it was shown that ropivacaine continuous wound infusion was beneficial.[48]

In order to determine the analgesic effectiveness of ropivacaine for postoperative pain following thoracolumbar spine surgery, Xu B et al. did a study in 2015. Patients in one group were given an IV containing multimodal analgesia, whereas patients in the other group had a pump administering 0.33% ropivacaine through the wound. There were no discernible variations in the two groups' pain levels, according to the authors. Therefore, the findings imply that the analgesic effects of local ropivacaine infusion were comparable to those of intravenous analgesic drug delivery. [49]

In order to evaluate the effectiveness of local anesthetic wound infiltration in lowering pain scores and narcotic intake in women after cesarean delivery, Adesope O et al. carried out a meta-analysis in 2016. Twenty-one trials in total—ten with a single infiltration method and eleven with an infusion technique—were included in the final analysis. They found that 24 hour opioid intake and pain scores at rest and during movement were reduced by local anesthetic wound infiltration. [50]

Epidural analgesia is frequently used for post-operative pain management following major abdominal surgery.[15] In order to enable a continuous infusion of local anesthetic drugs, this calls for the implantation of indwelling catheters in the epidural area. Numerous research studies have documented the advantageous outcomes of epidural analgesia subsequent to major abdominal surgery. Block BM et al. performed a meta analysis in 2003 to compare the effectiveness of parenteral opioids and post-operative epidural analgesia. Compared to parenteral opioids, epidural analgesia was found to give superior post-operative analgesia, irrespective of the analgesic drug, catheter placement location, type, and timing of pain evaluation. [51]

Li C et al. conducted a study in 2017 to compare the safety and effectiveness of epidural analgesia against local infiltration anesthetic for post-operative control following total knee replacement. The VAS score at rest or during mobilization at 12, 24, 48, and 72 hours was the main end point. The duration of stay, the range of mobility, and the incidence of nausea and vomiting are examples of secondary outcomes. Patients receiving either epidural or local infiltration analgesia had comparable VAS values at 12 and 24 hours. In terms of managing pain with improved range of motion, decreased incidence of nausea, and shorter hospital stays for patients undergoing local infiltration analgesia, it has been found that this method is just as effective as epidural analgesia. [52]

In order to assess continuous local anesthetic wound infiltration with epidural analgesia for post-operative pain following abdominal surgery, Ventham NT et al. undertook a study in 2013. This investigation involved 505 patients in all. The main result was the pain score at rest using the NRS after a 24-hour period. Pain scores at rest and during movement at 24 and 48 hours are secondary outcomes. It was determined that both the need for opiates and pain scores on mobility were decreased with epidural analgesia. [53]

In a 2018 study, Mehta S et al. compared the use of 0.2% bupivacaine and 0.2% ropivacaine for postoperative epidural analgesia following major lower limb orthopedic surgery. For postoperative analgesia through a lumbar epidural catheter, 100 patients, ages 18 to 70, undergoing elective major lower limb orthopedic surgery under spinal anesthesia, were randomly assigned to receive either 7 ml ropivacaine 0.2% (Group R) or 7 ml bupivacaine 0.2% (Group B). According to the scientists, 0.2% ropivacaine produced postoperative analgesia that was both effective and non-motor blocking, exhibiting a distinct sensorymotor separation. [54]

Numerous investigations have been conducted to assess the effectiveness of 0.2% ropivacaine in comparison to other anesthetic agents for the treatment of post-operative pain.
In order to ascertain the postoperative analgesic impact of ropivacaine in wound instillation for lumbar laminectomy, Saini D et al conducted a study in 2018. Forty patients were enrolled and randomized into two groups: Group R (n = 20) received 20 ml of 0.25% ropivacaine as an instillation over the incision site, and Group N (n = 20) received 20 ml of normal saline. The patients were scheduled for elective lumbar laminectomy under general anesthesia. The groups' post-operative pain scores, analgesic duration, and total amount of rescue analgesic needed in a 24-hour period were compared. Compared to patients who got normal saline wound instillation, those who received ropivacaine

wound instillation had better pain control, longer duration of analgesia, and less need for analgesics. [7]

112 patients undergoing lumbar fusion were examined and split into two groups (ropivacaine and control groups) in a retrospective study done in 2020 by Kunpeng Li et al. The Visual Analogue Scale (VAS) score, the amount of analgesics used, the number of patients in need of rescue analgesics, the length of stay in the hospital, and the frequency of complications were all noted. According to the study, the ropivacaine group consumed less sufentanil at 8, 12, 24, 48, and 72 hours after surgery ($P < 0.001$). Within 4 to 8 hours after surgery, fewer patients in the ropivacaine group (10/60 vs. 19/52, $P = 0.017$) needed rescue analgesia. In addition, compared to control cohorts, patients undergoing ropivacaine wound infiltration had shorter hospital stays. [55]

Benyahia et al in 2015 conducted a study on postoperative analgesia for spine surgeries and observed that most spine procedures, particularly the most advanced ones, were carried out under general anesthesia. This had to be explained by the position needed for the procedure, the anesthesiologist's or surgeon's preference, and the paucity of research that adequately supports locoregional anesthesia. Furthermore, a growing trend favored using general anesthesia instead of local anesthesia during spinal surgery. However, over 80% of the real research on neuraxial blocks pertaining to spine procedures is dated within the last 12 years. The viability of using (loco) regional approaches intraoperatively was the primary focus this study. These methods were also useful for postoperative analgesia, either in combination or as a single bolus injection of opioids, adjuvants, and local anesthetics either continuously or intermittently. Postoperative pain management using epidural analgesia has been regarded as a safe and effective technique. It has been utilized for scoliosis correction as well as major spinal surgery, laminectomy, microdiscectomy, and other types of spine surgery with or without instrumentation. Most retrospective and prospective investigations have reported

advantages in terms of reduced pain scores, decreased need for opioid rescue, and increased satisfaction after neuraxial analgesia. [56]

A 2014 study by Das A et al. compared the analgesic profiles of ropivacaine and dexmedetomidine when administered via epidural route as adjuvants. Two groups, ropivacaine + clonidine (group C) and ropivacaine + dexmedetomidine (group D), were randomly assigned to the forty-four subjects—twenty male and twenty female—who had undergone elective lumbar spine surgery. The surgeon used direct vision to insert an epidural catheter at the conclusion of the procedure. Through the catheter, group D received 20 ml 0.2% ropivacaine + 1 µg/kg dexmedetomidine and group C received 20 ml 0.2% ropivacaine + 2 µg/kg clonidine. Notes were made regarding the analgesic's onset, time to peak effect, duration, hemodynamic parameters, and adverse effects. The conclusions that were interpreted were Group D patients exhibited improved hemodynamic stability, a longer duration of analgesia, an earlier peak effect, and a quicker onset. While sedation scores were higher in group D, the prevalence of nausea, vomiting, respiratory depression, dry mouth, and motor block were similar in both groups. During the initial post-operative phase following lumbar spine surgery, epidural analgesia using ropivacaine and alpha 2 adrenergic agonists offered safe and effective pain reduction. [57]

Consequently, numerous studies have demonstrated the advantages of ropivacaine infiltration at the incision site in terms of lowering the need for post-operative opioids. Similarly, a tried-and-true, secure, and successful method for treating post-operative pain following major procedures is the epidural administration of local anesthetics.

Stamenkovic et al conducted a study in 2021 and showed that as part of multimodal analgesia following general or regional anesthesia, local anesthetic wound infiltration (WI) increases postoperative analgesia and provides anesthesia for minor surgical procedures. While pre-incisional block is ideal, WI is typically performed at the conclusion

of medical procedures. WI When used continuously, this technique lowers the need for analgesics, extends the time that analgesia lasts, and, in certain situations, improves patient movement. Benefits of WI have been shown in open abdominal procedures (e.g., colorectal, abdominal hysterectomy, herniorrhaphy, caesarean section), laparoscopic cholecystectomy, radical prostatectomy, oncological breast operations, laminectomy, and hallux valgus surgery. Understanding anatomy and the source of discomfort during an operation are necessary for surgical site infiltration. Additionally, a systematic, thorough infiltration of local anesthetic is required in multiple tissue planes under direct visibility prior to wound closure or subcutaneously along the incision. Appropriate local anesthetic dose is essential since 11% of cases of systemic toxicity from local anesthetics occur after subcutaneous WI. [41]

Blumenthal et al.'s study compared the efficacy of epidural ropivacaine and intravenous morphine for treating pain after scoliosis surgery utilized 0.3% ropivacaine. One pilot study that demonstrated that 0.3% ropivacaine solution was superior than 0.2% solution in pain management helped them make their conclusion. However, a higher concentrated solution can raise the patient's chance of motor obstruction, which is an undesirable side effect after spine surgery. [58]

Zaric et al. examined the effects of 0.25% bupivacaine and 0.1%, 0.2%, and 0.3% ropivacaine. Motor block was minimal with 0.1% ropivacaine, permitting subject mobilization; moderate with 0.2 and 0.3% ropivacaine; and most intense with 0.25% bupivacaine. The drug was selected at a lower concentration (0.2%) in order to avoid motor obstruction and hemodynamic instability. [59]

MATERIAL AND METHODS

SOURCE OF DATA

The study was conducted in a prospective, randomized, double blinded manner in the department of Anesthesiology, Dayanand Medical College Hospital, Ludhiana after obtaining clearance from hospital ethics committee. The study included 60 patients of either gender between age group 18 to 65 years belonging to ASA grade I, II and III scheduled for elective lumbar laminectomy under general anesthesia and were randomly allocated to two groups of 30 patients each.

METHOD OF COLLECTION OF DATA

Inclusion Criterion

Patients of either gender belonging to age group 18 to 65 years with ASA grade I, II and III scheduled for elective lumbar laminectomy under general anesthesia.

Exclusion Criterion

- Pregnant patients.
- History of previous spine surgery.
- Patients having a history of drug abuse, psychiatric disorders and inability to comprehend NRS.
- History of allergy to local anesthetic agent

Group Allocation

Patients were randomly allocated into two groups, Group A and B, using computer generated random number list which was kept in a sealed opaque envelope and opened at the completion of study. The study drug was administered by the operating surgeon on completion of surgical procedure.

Group A - Patients were administered local wound infiltration of 10 ml 0.2% of ropivacaine.

Group B - Patients were administered epidural instillation of 10 ml 0.2% ropivacaine.

The anesthesia resident monitoring the patient in post anesthesia care unit was aware of the group allocation and site of 0.2 % ropivacaine administration.

Pre-anesthetic check up

A detailed pre-anesthetic checkup was conducted preoperatively one day prior to surgery comprising of detailed history, general, physical and systemic examination. Patient was counselled and explained regarding the surgical procedure and demonstrated the use of NRS.

Premedication

All patients were kept nil per oral before surgery. The fasting period was eight hours for solids and 2 hours for clear liquids. They were also be explained that they can request for analgesic whenever they experience pain. Pre-medication in the form of Tab Alprazolam 0.5 mg was administered to all patients the night before surgery.

ANESTHESIA TECHNIQUE

Vitals were monitored again in the pre-operative holding area. After arrival of patient to the operating room, standard monitoring such as electrocardiogram (ECG), non-invasive blood pressure (NIBP), heart rate (HR) and arterial oxygen saturation (SpO2) were started and baseline parameters were recorded. IV line was secured using an appropriate cannula and I/V fluid was infused. After standard anesthesia induction using IV Propofol, patients were paralyzed using Inj Atracurium 0.5 mg/Kg and endotracheal intubation was performed using appropriate endotracheal tube. Intra-operatively, anesthesia was maintained using oxygen, nitrous oxide and desflurane or isoflurane. Intra-operative analgesia was provided by bolus Injections of Fentanyl. Volatile agent concentration, muscle relaxant and analgesic administration were titrated as per the discretion of anesthesiologist.

To avoid variation in surgical and anesthesia technique, all cases operated by the same team of neurosurgeon and anesthesiologist was enrolled for the study.

Patients were continuously monitored for the duration of surgery and vitals were recorded every 5 minutes.

After the completion of surgery, patients were administered study drug as per random group allocation.

Group A was administered local wound infiltration of 10ml of 0.2% ropivacaine just before applying subcutaneous sutures, whereas, for Group B, 10ml of 0.2% ropivacaine was instilled in the epidural space before surgical wound closure. The wound closure would begin after drug administration and wound would be closed in layers without suctioning or mopping.

All patients were administered infusion of paracetamol 1 gm IV beginning with wound closure. At the end of procedure, residual neuromuscular blockade was reversed with neostigmine 0.05 mg/kg and glycopyrrolate 0.01 mg/kg and ETT was removed.

Post-operatively, patients were shifted to the PACU, where they were monitored by an anesthesiologist who would not be aware of the group allocation.

In PACU, HR, NIBP, SpO2 and recording of NRS was done every hourly for the initial 4 hours and after that every four hourly till the initial 24 hours. At any time, if patients complain of pain or if the NRS ≥ 4, Inj morphine 5mg IV were administered and recorded. NRS at the time of morphine administration and total morphine consumption in the 24 hours was recorded. The duration of analgesia was defined as time interval from administration of study drug to requirement for first rescue analgesia. The degree of motor blockade if any was also recorded using a modified Bromage score every hourly for the first 4 hours and after that every four hourly till the initial 24 hours.

Any adverse event like nausea, vomiting, bradycardia (defined as heart rate less than 60 beats/min), respiratory depression (defined as respiratory rate < 8 breaths/min), hypotension (defined as fall in mean BP less below 20 % of baseline), were recorded and treated as per PACU protocols. Patients were also followed up for any wound hematoma/ wound dehiscence/ infection for the first 24 hours.

Observations:

The following parameters were recorded and statistically analysed**:**

Primary outcome: Total rescue analgesic consumption in 24 hours

Secondary outcome: Post operative pain scores assessed by NRS.

Statistical Analysis

The objective of the study was to compare the analgesic consumption in patients in 24 hours.

The formula used was as under:

$n = (\sigma 12 + \sigma 22) (Z\alpha + Z\beta)^2/(m1 – m2)^2$

Where,

Zα = Value of standard normal variate corresponding to α level of significance (1.96)

Zβ = The standard normal deviate for desired power (0.842)

m = Average

σ = Standard deviation

Assumptions:

From the Pilot study conducted,

Mean Group (m1) = 9

Mean Group (m2) = 12

Coefficient of variation = 150%

Standard deviation Group (σ1) = 3.7

Standard deviation (σ2) = 2.7

With the above assumptions the sample size for 95% confidence level & 90% power works out 25 in each group. This number was increased to 30 per group (a total of 60) to allow for a predicted dropout from treatment.

DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

No.

HAS ETHICAL CLEARANCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3?

Attached herewith.

OBSERVATIONS AND RESULTS

The present study was conducted in a randomized, double blinded manner in the Department of Anesthesiology, DMCH Ludhiana on a total of 60 adult patients of either sex, between age group 18 to 65 years belonging to ASA grade I, II and III who were scheduled for lumbar laminectomy under general anesthesia.

The study aimed to evaluate the comparative efficacy of local wound infiltration of 0.2% of 10ml ropivacaine with epidural instillation of 0.2% of 10ml ropivacaine.

Patients were divided into two groups of 30 patients each and were administered study of volume of 10 ml.

Group A patients were administered sub-cutaneous wound infiltration of 10ml of 0.2% ropivacaine. Group B patients were administered 10ml of 0.2% ropivacaine instilled in the epidural space.

After extubation, the patients were shifted to PACU and this time was labelled as '0'. Post operative pain scores and hemodynamic parameters were monitored for 24 hours in PACU.

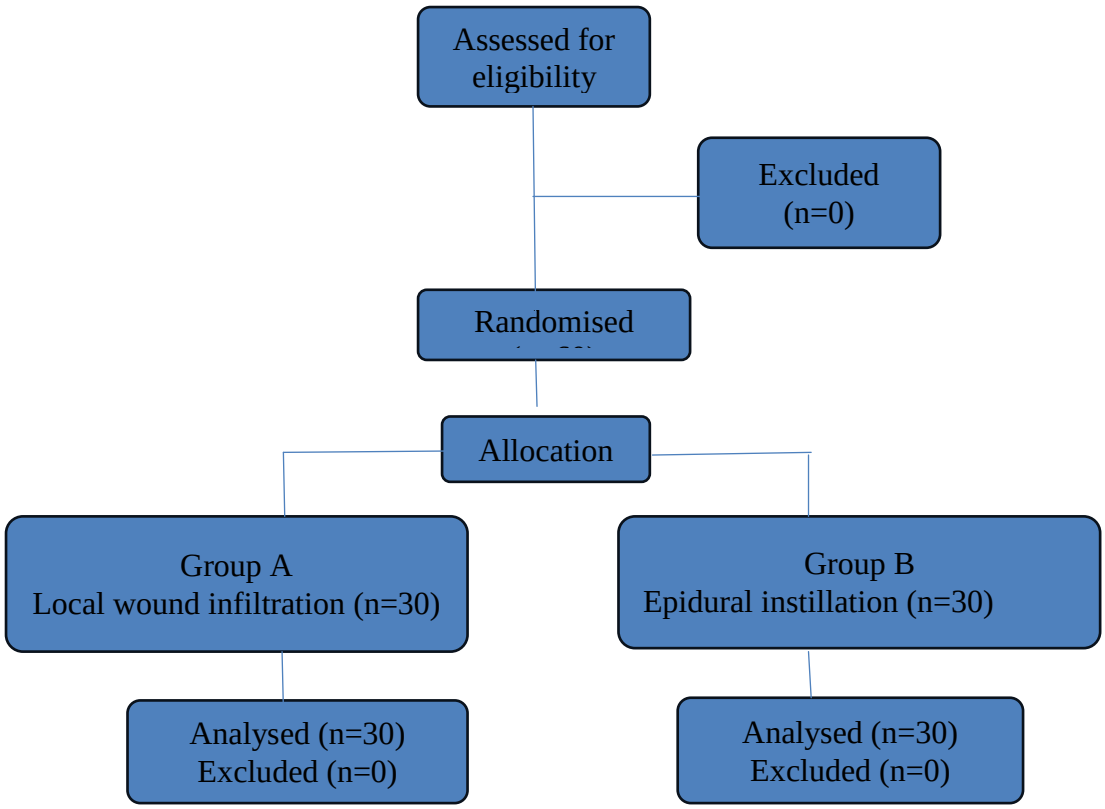


Figure 1: CONSORT flow diagram of the study

DEMOGRAPHIC PROFILE

TABLE 1: MEAN AGE DISTRIBUTION

	GROUP A	GROUP B
	Mean	**Mean**
AGE (years)	50.17	47.00

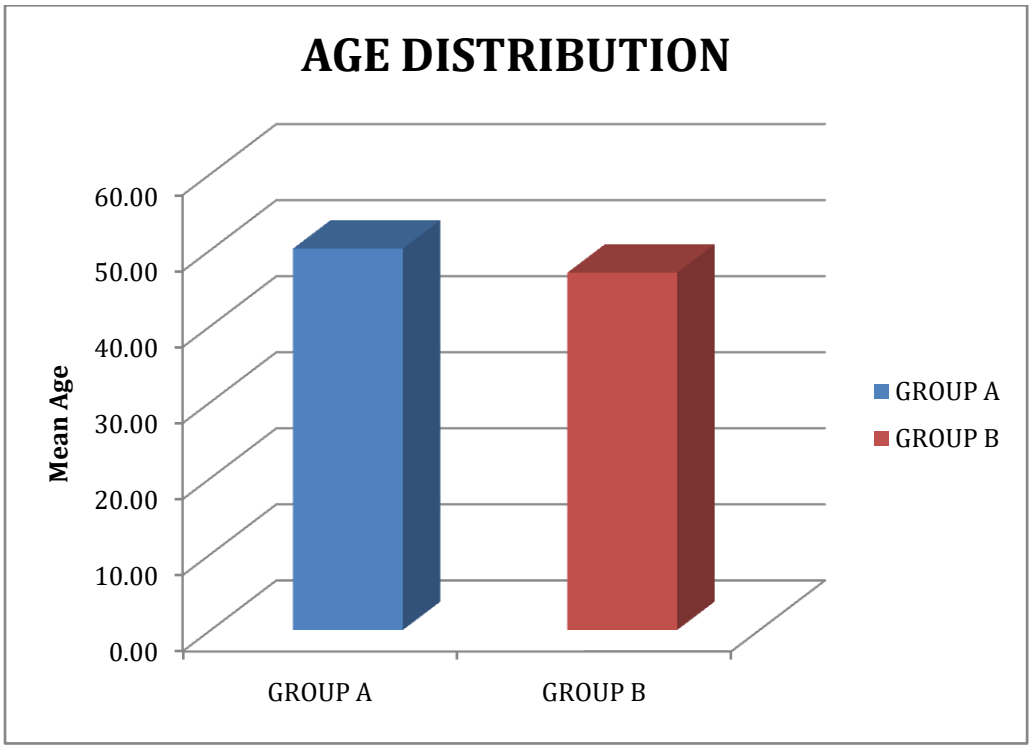


Figure 2: Mean age distribution

Mean age of patients in group A was 50.17±10.1 years, whereas, it was 47±13.96 years in group B. There was no statistically significant difference among the two groups with respect to age, p value being 0.317 (Table 1, Figure 2).

TABLE 2: GENDER DISTRIBUTION

		GROUP A		GROUP B		TOTAL	CHI SQUARE	P-VALUE
		NO OF CASES	%	NO OF CASES	%	TOTAL		
GENDER	Female (F)	12	40%	11	36.3%	23	0.071	0.791
	Male (M)	18	60%	19	63.3%	37		
TOTAL		30	100%	30	100%	60		

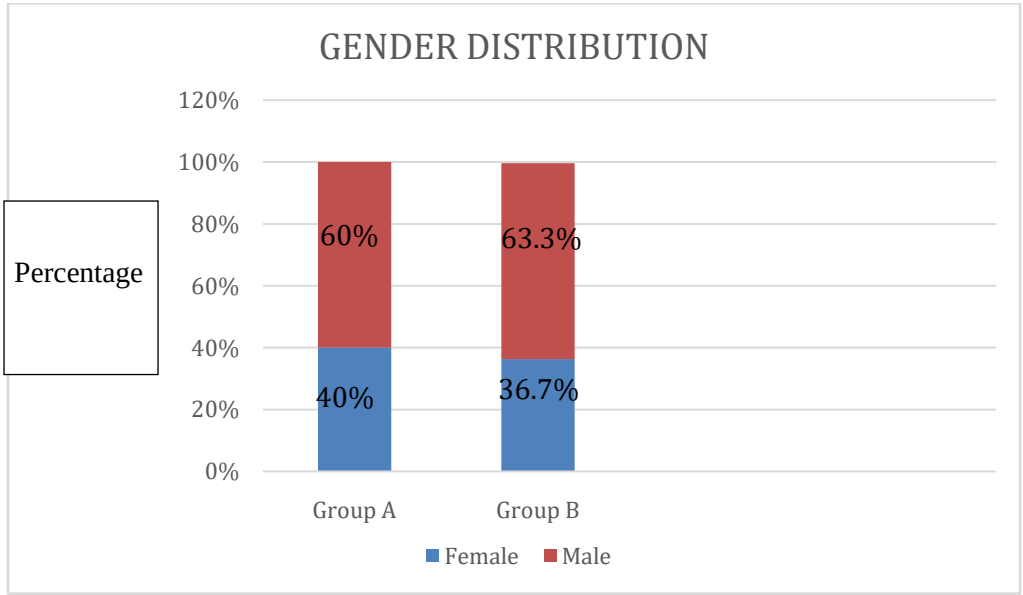


FIGURE 3: Gender Distribution

In group A, 12 (40%) were females and 18 (60%) were males. In Group B there were 11 (36.7%) females and 19 (63.3%) males.With a p-value of 0.791, the gender distribution in both groups was statistically identical. [Table 2, Figure3]

Table 3: Mean weight

	GROUP A	GROUP B
	Mean	**Mean**
WEIGHT (Kg)	72.17	71.17

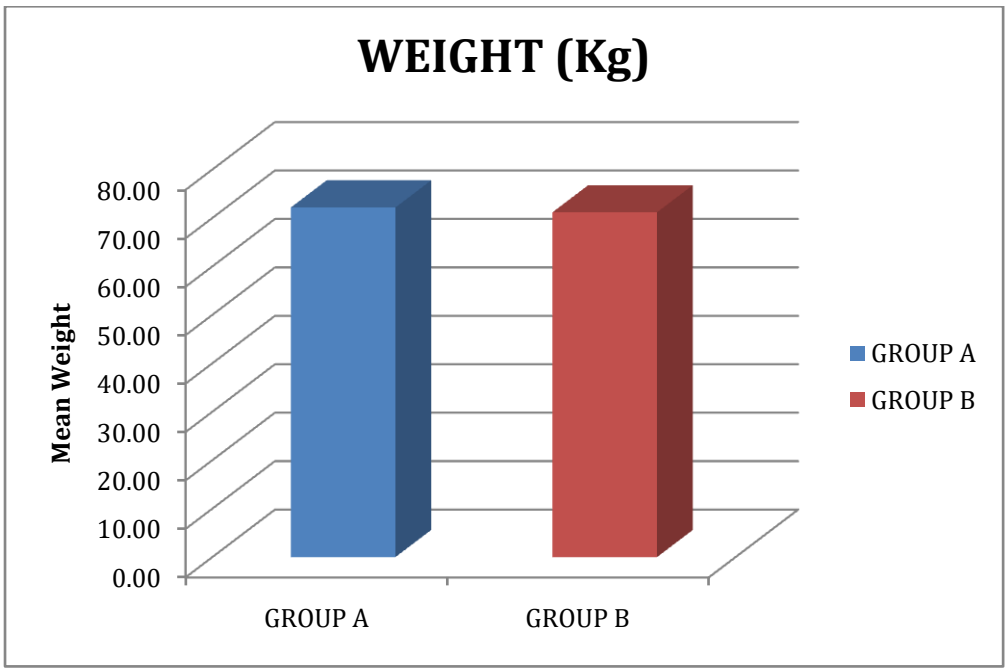


Figure 4: Mean weight

Mean weight of patients in group A was 72.17±8.26 kg, the same being 71.17±8.69 kg in group B. There was a statistically insignificant difference in the mean weight between the two groups (p value 0.612). (Table 3, Figure 4).

Table 4: Mean height

	GROUP A		GROUP B		p-value
	Mean	SD	Mean	SD	
Height (cm)	165.6	5.18	166.5	5.01	0.579

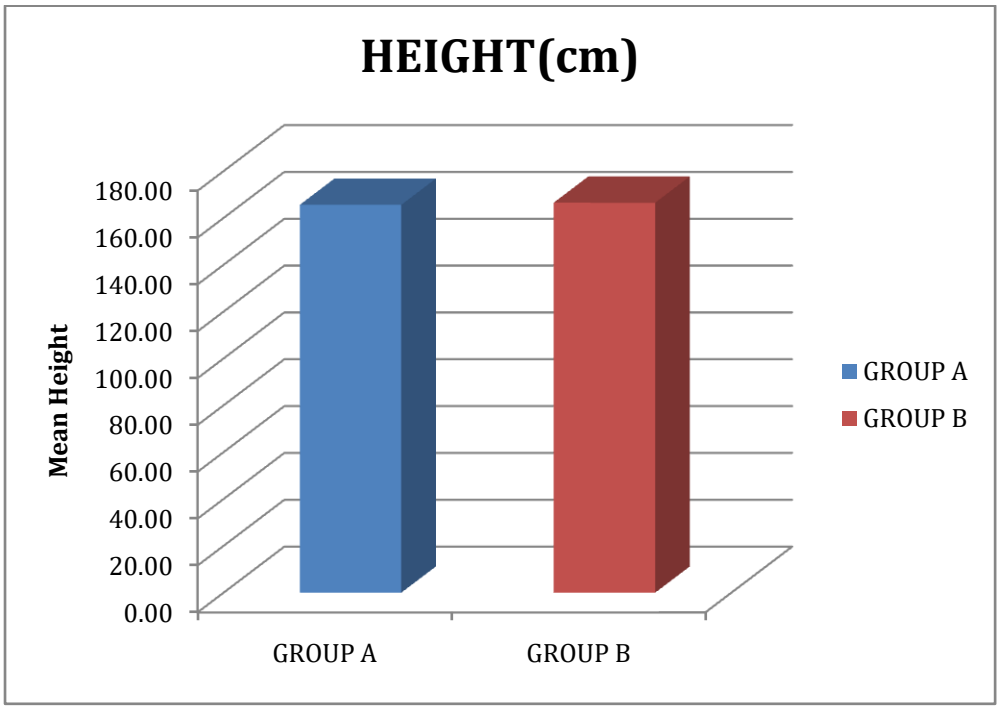


Figure 5: Mean height

Mean height of patients in group A was 165.6 ± 5.18 cm, whereas, the same in group B was 166.5 ± 5.01 cm. There was a statistically insignificant difference in the mean height between the two groups (p value 0.664). (Table 4, Figure 5).

Table 5: Mean BMI

	GROUP A		GROUP B		
	Mean	**SD**	**Mean**	**SD**	**P value**
BMI (kg/m^2)	26.13	2.57	25.51	2.89	0.809

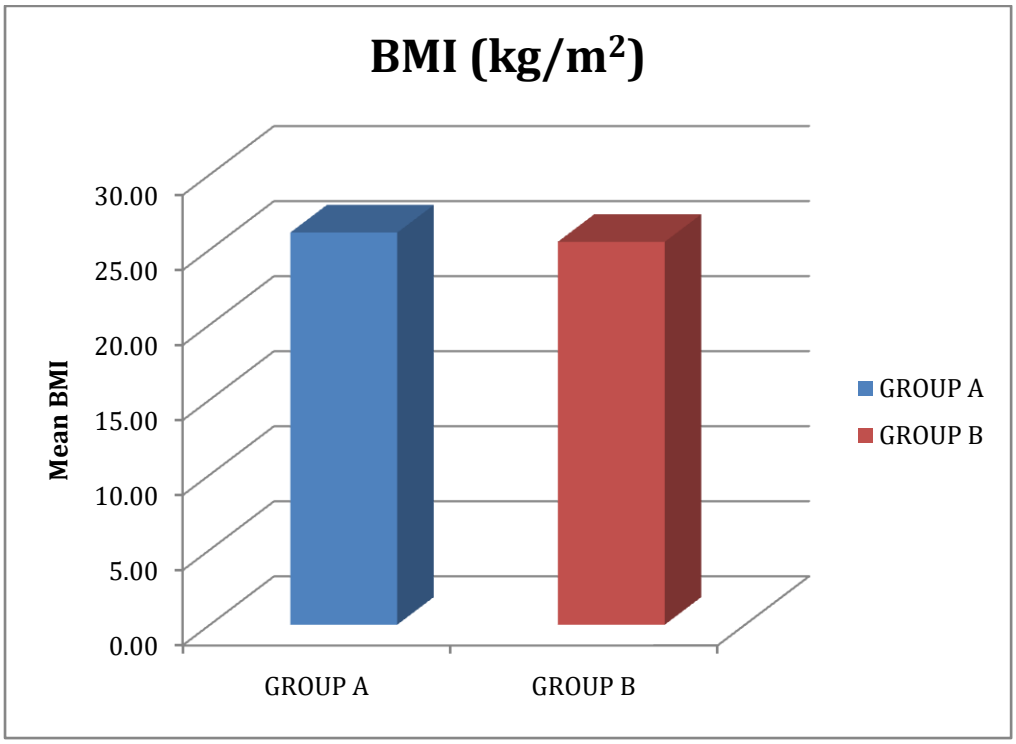


Figure 6: Mean BMI

Mean BMI in group A was 26.13±3.45 kg/m^2, whereas, in group B was 25.51±2.89 kg /m^2. With a p value of 0.809, the difference in the patients' mean BMI between the two groups was statistically insignificant. (Table 5, Figure 6)

TABLE 6: DIAGNOSIS OF CASES OF GROUP A and B

		GROUP A		GROUP B		Total	Chi-square value	p-value
		No. of cases	%age	No. of cases	%age			
DIAGNOSIS	DORSAL SPINE FIXATION	0	0.0%	1	3.3%	1	2.363	0.307
	LUMBAR CANAL STENOSIS	5	16.7%	2	6.7%	7		
	PIVD	25	83.3%	27	90.0%	52		
Total		30	100.0%	30	100.0%	60		

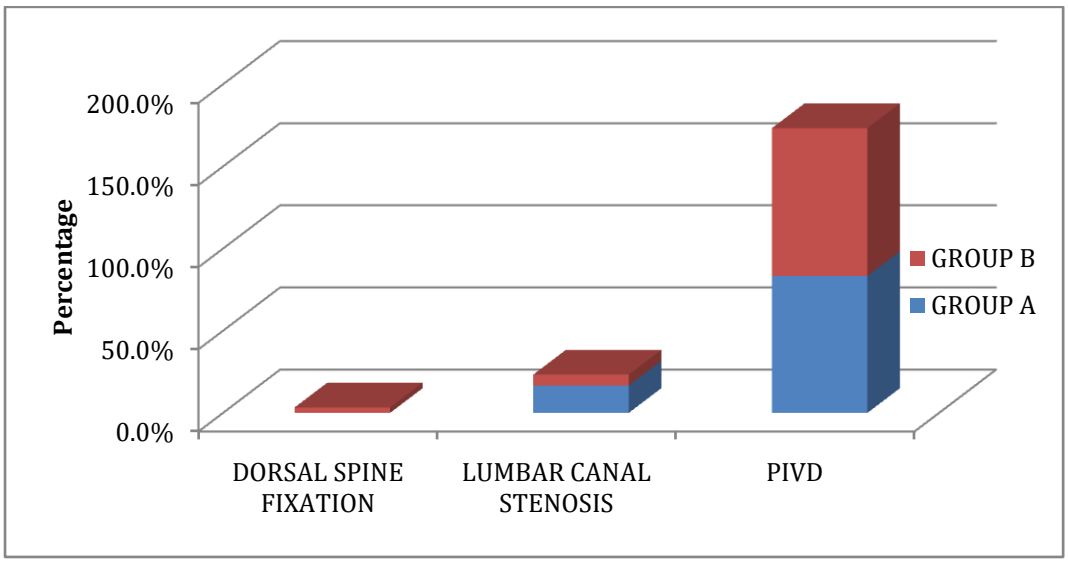


Figure 7: Diagnosis of cases of group A and B

In group A, 5 cases (16.7%) had the diagnosis of lumbar canal stenosis and 25 (83.3%) cases were diagnosed with prolapse intervertebral disc. In group B, 1 patient (3.3%) was operated for dorsal spine fixation, 2 patients (6.7%) had the diagnosis of lumbar canal stenosis and 27(90.0%) cases were of PIVD. Overall, patients in both groups had similar distribution of diagnosis for which surgeries were performed. [Table 6, figure 7]

Table 7: ASA physical status

		GROUP A		GROUP B		Total	Chi-square value	p-value
		No. of cases	%age	No. of cases	%age			
ASA	I	1	3.3%	7	23.3%	8	5.318	0.070
	II	25	83.3%	19	63.3%	44		
	III	4	13.3%	4	13.3%	8		
Total		30	100%	30	100%	60		

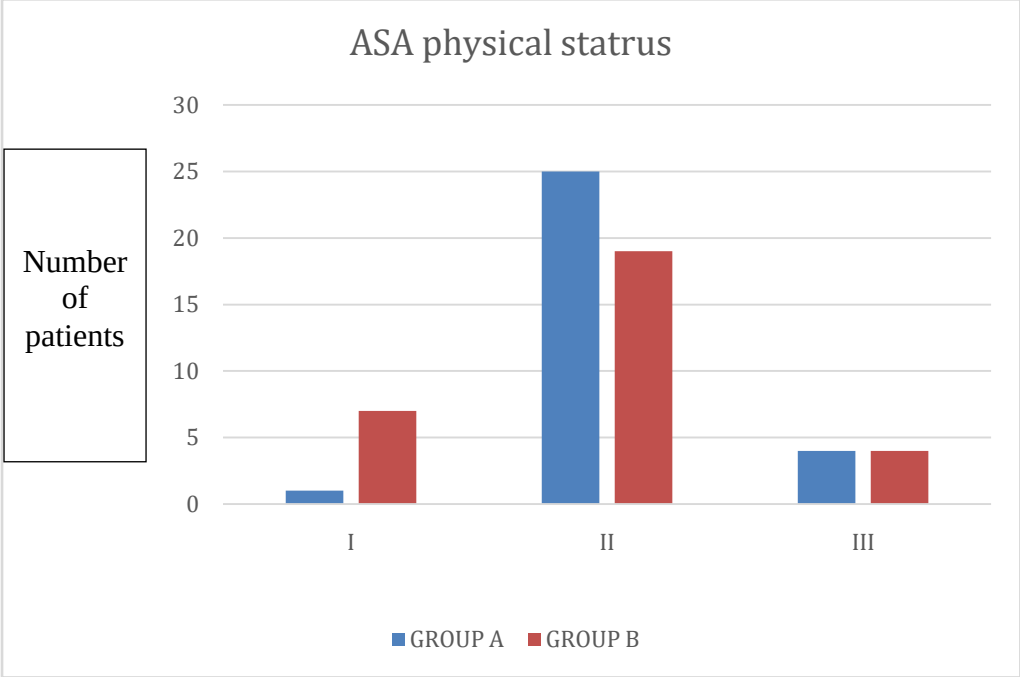


FIGURE 8: ASA physical status

Group A had 1 patient (3.3%) of ASA class I, 25 patients (83.3%) of ASA class II and 4 patients (13.3%) of ASA class III. Group B had 7 patients (23.3%) of ASA class I, 19 patients (63.3%) of ASA class II and 4 cases (13.3%) of ASA class III. The difference in ASA distribution in the both the groups was statistically insignificant. (p value 0.070) (Table 7, Figure 8)

Table 8: Mean heart rate (HR) after administration of study drug

	GROUP A		GROUP B		Z	p-value
	Mean	SD	Mean	SD		
0 HOUR	80.77	3.65	79.60	5.59	-0.443	0.658
1 HOUR	84.93	6.34	82.87	6.31	1.266	0.211
2 HOUR	90.93	8.06	87.17	8.08	-1.625	0.104
3 HOUR	93.53	6.27	91.90	10.72	-0.314	0.753
4 HOUR	90.63	5.99	92.07	9.99	-0.855	0.393
8 HOUR	94.07	8.54	90.70	10.05	-1.267	0.205
12 HOUR	91.87	7.62	86.83	7.36	-2.383	0.017
16 HOUR	86.60	5.35	83.30	5.86	-2.062	0.039
20 HOUR	82.53	3.05	80.83	4.85	-0.761	0.446
24 HOUR	79.73	2.30	79.40	4.87	-1.719	0.086

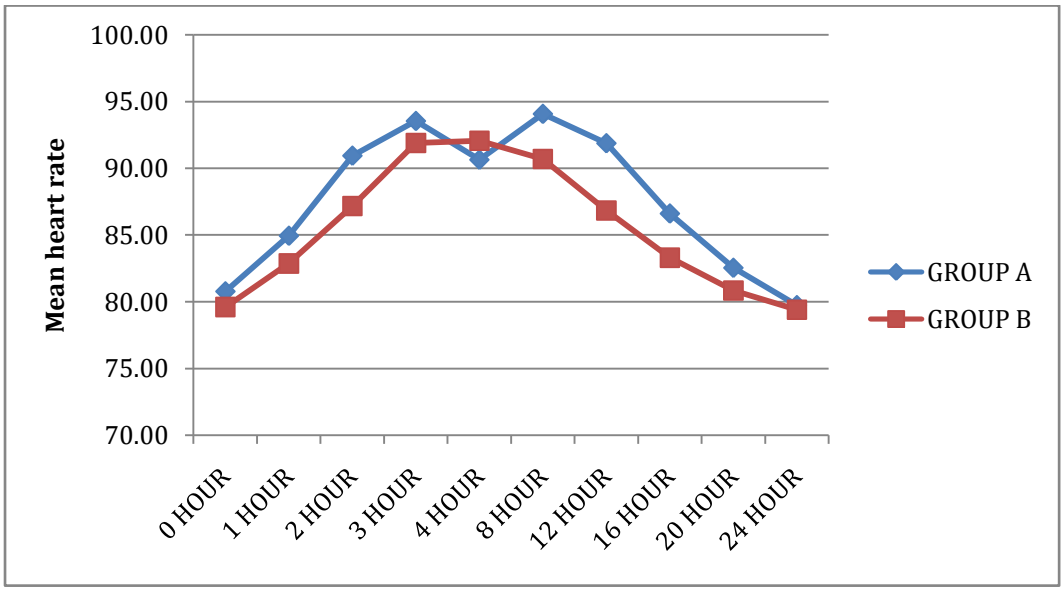


Figure 9: Mean heart rate after administration of study drug

The mean baseline heart rate was comparable in both the groups (p value= 0.658). The mean heart rate was similar in both the groups at all time intervals; except at 12 hour and 16 hour where it was found to be significantly lower in group B as compared to group A. [Table 8, Figure 9]

TABLE 9: MEAN SYSTOLIC BLOOD PRESSURE AFTER SHIFTING TO PACU

	GROUP A		GROUP B		Z	p-value
	Mean	SD	Mean	SD		
0 HOUR	118.80	6.03	117.93	7.15	-0.525	0.599
1 HOUR	126.63	8.47	124.30	8.78	-0.947	0.343
2 HOUR	134.20	10.31	130.13	9.86	-1.465	0.143
3 HOUR	138.03	6.77	136.27	9.38	-0.509	0.611
4 HOUR	134.87	7.14	136.43	8.42	-1.037	0.300
8 HOUR	137.57	9.52	134.30	9.82	-1.205	0.228
12 HOUR	134.60	9.23	126.90	7.38	-3.165	0.002
16HOUR	126.37	8.62	121.10	7.21	-2.427	0.015
20 HOUR	120.07	7.57	115.57	5.87	-2.262	0.024
24 HOUR	114.63	5.31	113.70	5.54	-0.831	0.406

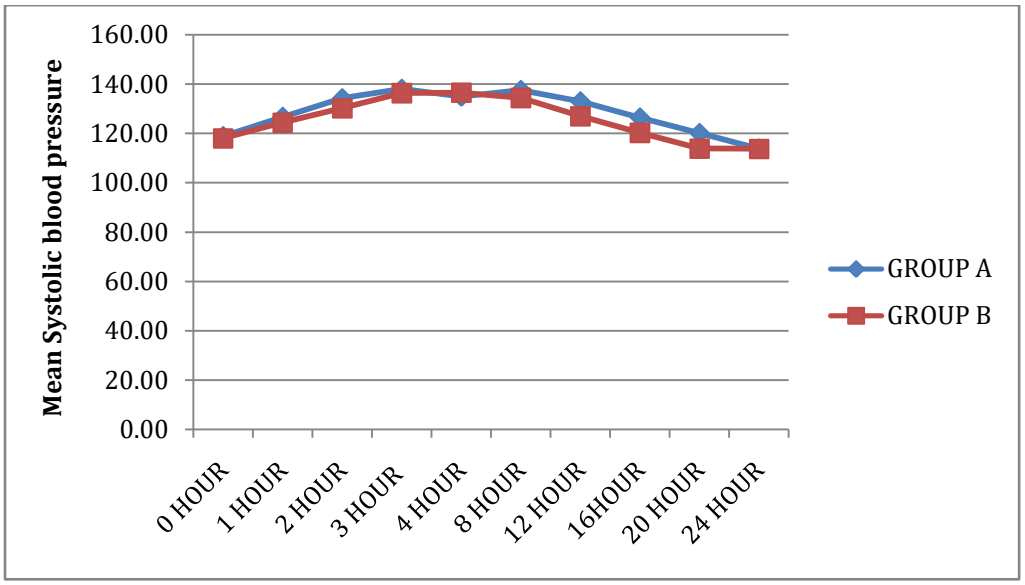


Figure 10: Mean systolic blood pressure after shifting to PACU

The mean baseline systolic blood pressure was statistically similar in both the groups (p value= 0.599). The mean systolic blood pressure was similar in both the groups at all time intervals; except at 12 hour, 16 hour and 20 hour where it was found to be significantly lower in group B as compared to group A. [Table 9, Figure 10]

Table 10: Mean Diastolic Blood Pressure after shifting to PACU

TIME RECORDINGS	GROUP A		GROUP B		Z	p-value
	Mean	SD	Mean	SD		
0 HOUR	78.67	2.92	78.87	3.04	-0.593	0.553
1 HOUR	82.43	4.03	80.73	3.89	-1.840	0.066
2 HOUR	80.90	6.93	80.97	6.45	-0.296	0.767
3 HOUR	83.40	7.33	83.03	5.19	-0.284	0.776
4 HOUR	80.47	4.12	81.80	5.73	-1.466	0.143
8 HOUR	82.50	6.47	83.47	5.07	-1.047	0.295
12 HOUR	82.13	6.41	79.87	4.26	-1.958	0.050
16 HOUR	79.33	5.23	79.50	3.16	-0.600	0.548
20 HOUR	78.17	4.25	78.73	3.50	-0.741	0.459
24 HOUR	78.00	4.07	78.70	3.37	-0.755	0.450

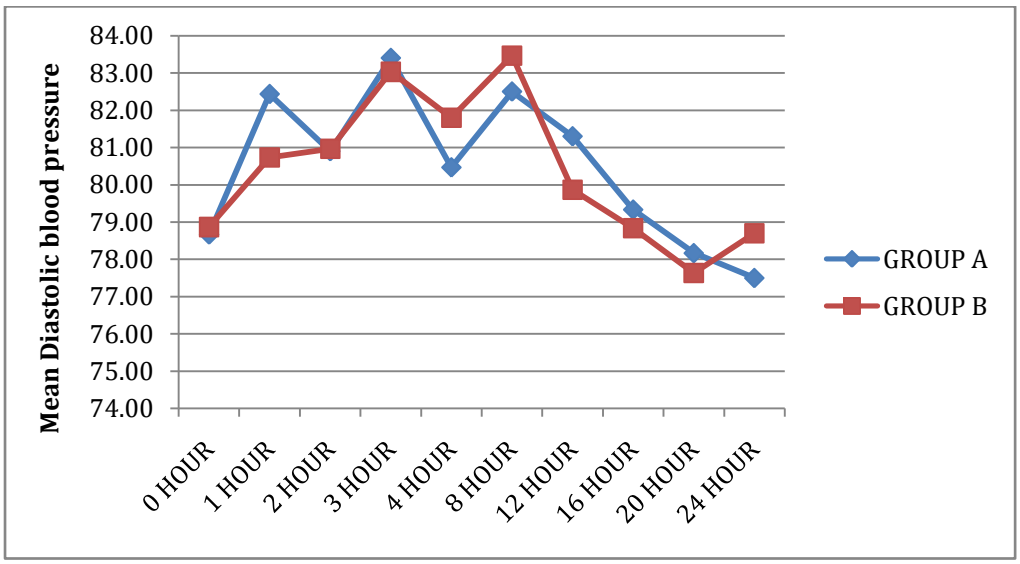


Figure 11: Mean diastolic blood pressure after shifting to PACU

The mean baseline diastolic blood pressure was statistically similar in both the groups (p value= 0.553). The mean systolic blood pressure was similar in both the groups at all time intervals; except at 12 hour where it was found to be significantly lower in group B as compared to group A (p value=0.050). [Table 10, Figure 11]

Table 11: Mean Arterial Pressure after administration of study drug

TIME OF RECORDINGS	GROUP A		GROUP B		Z	p-value
	Mean	SD	Mean	SD		
0 HOUR	91.87	3.30	91.63	3.63	-0.144	0.886
1 HOUR	96.87	4.80	95.00	4.98	-1.288	0.198
2 HOUR	98.60	6.60	97.23	5.88	-0.981	0.327
3 HOUR	100.97	5.31	100.17	5.85	-0.595	0.552
4 HOUR	98.47	2.64	99.53	4.73	-1.167	0.243
8 HOUR	101.00	6.14	99.47	6.11	-0.638	0.524
12 HOUR	98.10	8.00	95.20	4.42	-2.310	0.021
16 HOUR	95.27	5.10	92.37	5.62	-1.780	0.075
20 HOUR	92.40	4.45	89.83	5.74	-1.953	0.051
24 HOUR	89.73	4.63	90.60	2.79	-0.191	0.849

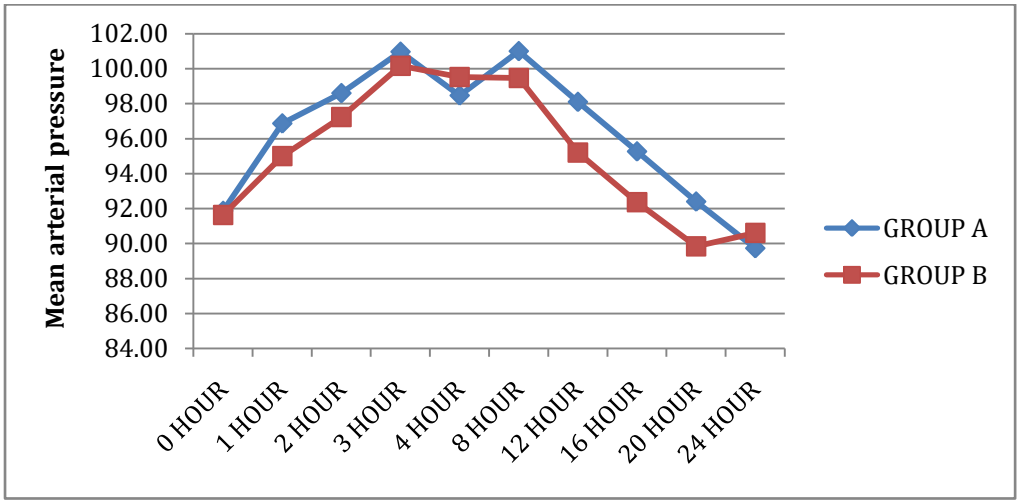


Figure 12: Mean arterial pressure after administration of study drug

The mean arterial pressure at baseline was statistically similar in both the groups (p value= 0.886). The mean arterial pressure was similar in both the groups at all time intervals; except at 12 hour where it was found to be significantly lower in group B as compared to group A (p value=0.021). [Table 11, Figure 12]

Table 12: Respiratory rate after study of administered drug

	GROUP A		GROUP B		Z	p-value
	Mean	SD	Mean	SD		
0HOUR	17.00	0.00	17.00	0.00	0.000	1.000
1HOUR	18.00	0.00	18.00	0.00	0.000	1.000
2HOUR	17.00	0.00	17.00	0.00	0.000	1.000
3HOUR	18.00	0.00	18.00	0.00	0.000	1.000
4HOUR	17.00	0.00	17.00	0.00	0.000	1.000
8HOUR	17.00	0.00	17.00	0.00	0.000	1.000
12HOUR	17.00	0.00	17.00	0.00	0.000	1.000
16HOUR	18.00	0.00	18.00	0.00	0.000	1.000
20HOUR	18.00	0.00	18.00	0.00	0.000	1.000
24HOUR	17.00	0.00	17.00	0.00	0.000	1.000

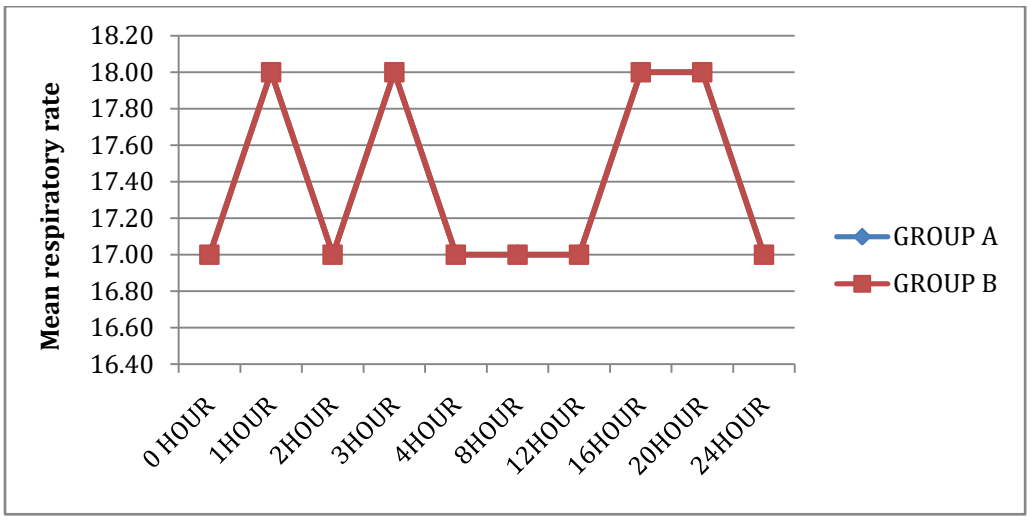


Figure 13: Mean respiratory rate after administration of study drug

All the patients had respiratory rate between normal reference range (16-20 breaths/min) at all measurement intervals. The difference of peripheral oxygen saturation between both the groups was statistically insignificant for the study period (p value >1.000) (Table 12, Figure 13)

Table 13: Mean oxygen saturation (SpO_2) after administration of study drug

Time Recordings	GROUP A		GROUP B		Z	p-value
	Mean	SD	Mean	SD		
0 hour (%)	98.00	0.00	98.00	0.00	0.000	1.000
1HOUR	98.00	0.00	98.00	0.00	0.000	1.000
2HOUR	98.00	0.00	98.00	0.00	0.000	1.000
3HOUR	98.00	0.00	98.00	0.00	0.000	1.000
4HOUR	98.00	0.00	98.00	0.00	0.000	1.000
8HOUR	99.00	0.00	99.00	0.00	0.000	1.000
12HOUR	98.00	0.00	98.00	0.00	0.000	1.000
16HOUR	98.00	0.00	98.00	0.00	0.000	1.000
20HOUR	97.00	0.00	97.00	0.00	0.000	1.000
24HOUR	98.00	0.00	98.00	0.00	0.000	1.000

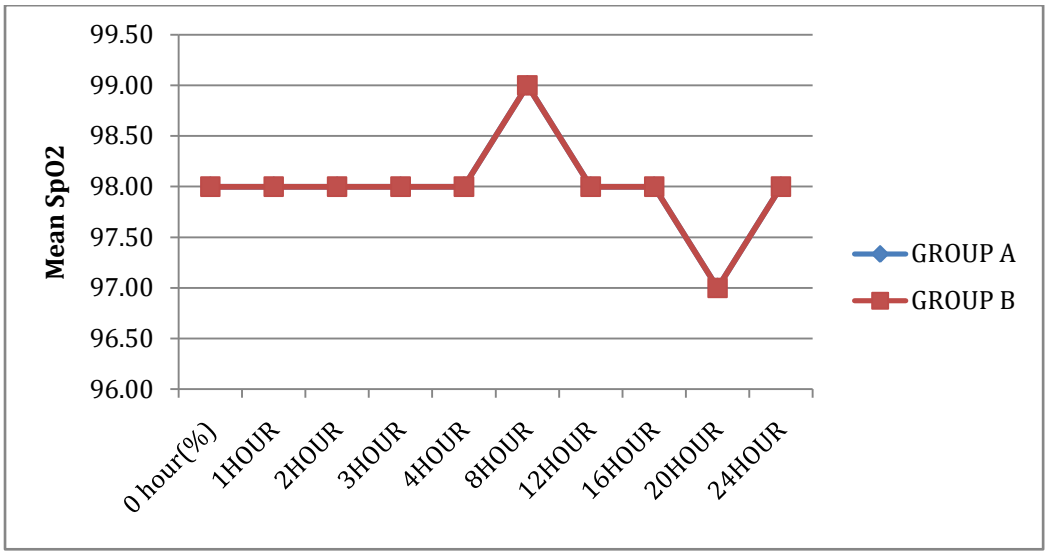


Figure 14: Mean oxygen saturation (SpO_2) after administration of study drug

All the patients had mean oxygen saturation within normal reference range (95%-100%) at all measurement intervals. The difference of peripheral oxygen saturation between both the groups was statistically insignificant for the study period (p value >1.000) (Table 13, Figure 14).

TABLE 14: NUMERICAL RATING SCORE AFTER SHIFTING TO PACU

TIME RECORDINGS	GROUP A		GROUP B		Z	p-value
	Mean	SD	Mean	SD		
0 HOUR	1.90	1.16	1.17	1.12	-2.528	0.011
1 HOUR	2.90	0.88	1.83	1.15	-3.710	0.001
2 HOUR	3.47	0.82	2.70	0.95	-3.323	0.001
3 HOUR	3.83	0.99	3.40	0.93	-1.790	0.073
4 HOUR	3.17	0.79	3.23	1.04	-0.198	0.843
8 HOUR	3.57	1.19	3.17	1.32	-1.158	0.247
12 HOUR	3.20	1.49	2.10	1.06	-2.941	0.003
16 HOUR	2.27	0.98	1.30	0.88	-3.524	0.001
20 HOUR	1.27	0.69	0.57	0.63	-3.641	0.001
24HOUR	0.60	0.56	0.27	0.45	-2.393	0.017

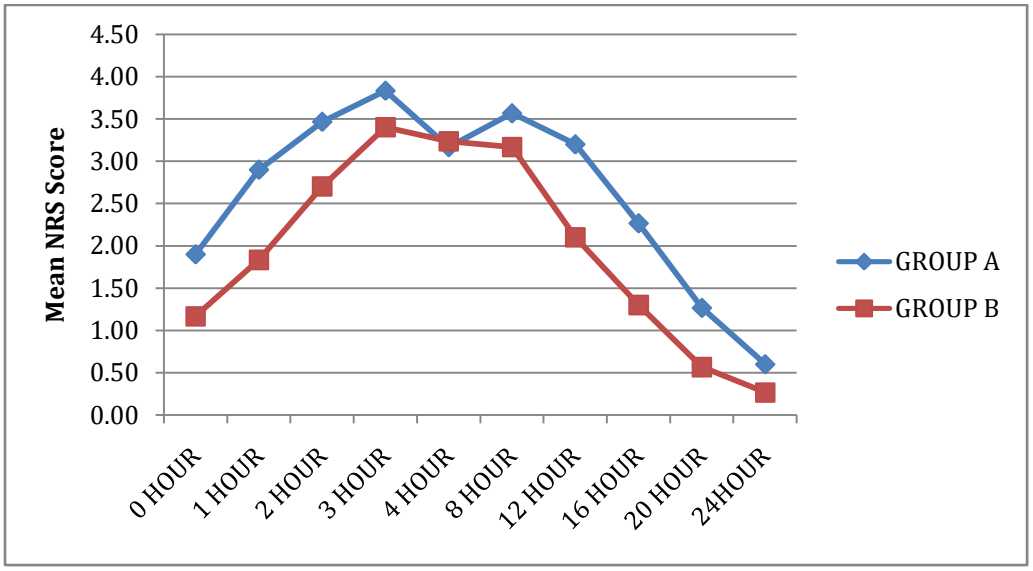


Figure 15: Numerical RatingScore after shifting to PACU

The mean numerical rating score at 0 hour after shifting to PACU was statistically significant with p value of 0.011, at 1 hour was statistically significant with p value of 0.001 and at 2 hour was statistically significant with p value of 0.001. However, numerical rating score at 3 hr, 4 hr and 8 hr was statistically insignificant. On intergroup comparison, mean numerical rating score was significantly lower in group B as compared to group A at 12, 16, 20 and 24 hour with p values of 0.003, 0.001, 0.001 and 0.017 respectively. [Table 14, figure 15]

TABLE 15: ADMINISTRATION OF RESCUE ANALGESIC IN PACU

		GROUP A		GROUP B		Total	Chi-square value	p-value
		No. of cases	%age	No. of cases	%age			
0 HOUR	0	30	100.0%	30	100.0%	60		
1 HOUR	0	23	76.7%	29	96.7%	52	5.192	0.052
	5	7	23.3%	1	3.3%	8		
2 HOUR	0	20	66.7%	27	90.0%	47	4.812	0.057
	5	10	33.3%	3	10.0%	13		
3 HOUR	0	13	43.3%	21	70.0%	34	4.344	0.067
	5	17	56.7%	9	30.0%	26		
4 HOUR	0	26	86.7%	23	76.7%	49	1.002	0.506
	5	4	13.3%	7	23.3%	11		
8 HOUR	0	17	56.7%	21	70.0%	38	1.148	0.422
	5	13	43.3%	9	30.0%	22		
12 HOUR	0	21	70.0%	29	96.7%	50	7.68	0.012
	5	9	30.0%	1	3.3%	10		
16 HOUR	0	28	93.3%	30	100.0%	58	2.069	0.492
	5	2	6.7%	0	0.0%	2		
20 HOUR	0	30	100.0%	30	100.0%	60		
24HOUR	0	30	100.0%	30	100.0%	60		

		GROUP A		GROUP B		Total	Chi-square value	p-value
		No. of cases	%age	No. of cases	%age			
No. of time RESCUE ANALGESIC ADMINISTERED	1	0	0.0%	30	100.0%	30	60	0.001
	2	28	93.3%	0	0.0%	28		
	3	2	6.7%	0	0.0%	2		
Total		30	100.0%	30	100.0%	60		

No rescue analgesic was given to any patient at 0 hour after shifting to PACU. Seven patients in group A and only one patient in group B received rescue analgesic between 0 hr to1 hr interval. Ten patients in group A and 3 patients in Group B received rescue analgesic between 1 hr to 2hour interval. The rescue analgesic given to the patients was statistically insignificant except at12 hr where rescue analgesic given in group B was significantly lower as compared to group A (p value=0.012). [Table 15]

TABLE 16: MODIFIED BROMAGE SCORE AFTER SHIFTING TO PACU

		GROUP A		GROUP B		Total	Chi-square value	p-value
		No. of cases	%age	No. of cases	%age			
0 HOUR	0	2	6.7%	7	23.3%	9	3.268	0.145
	1	28	93.3%	23	76.7%	51		
1 HOUR	0	17	56.7%	19	63.3%	36	0.278	0.598
	1	13	43.3%	11	36.7%	24		
2 HOUR	0	30	100.0%	30	100.0%	60	0.000	1.000
3 HOUR	0	30	100.0%	30	100.0%	60	0.000	1.000
4 HOUR	0	30	100.0%	30	100.0%	60	0.000	1.000
8 HOUR	0	30	100.0%	30	100.0%	60	0.000	1.000
12 HOUR	0	30	100.0%	30	100.0%	60	0.000	1.000
16 HOUR	0	30	100.0%	30	100.0%	60	0.000	1.000
20 HOUR	0	30	100.0%	30	100.0%	60	0.000	1.000
24 HOUR	0	30	100.0%	30	100.0%	60	0.000	1.000

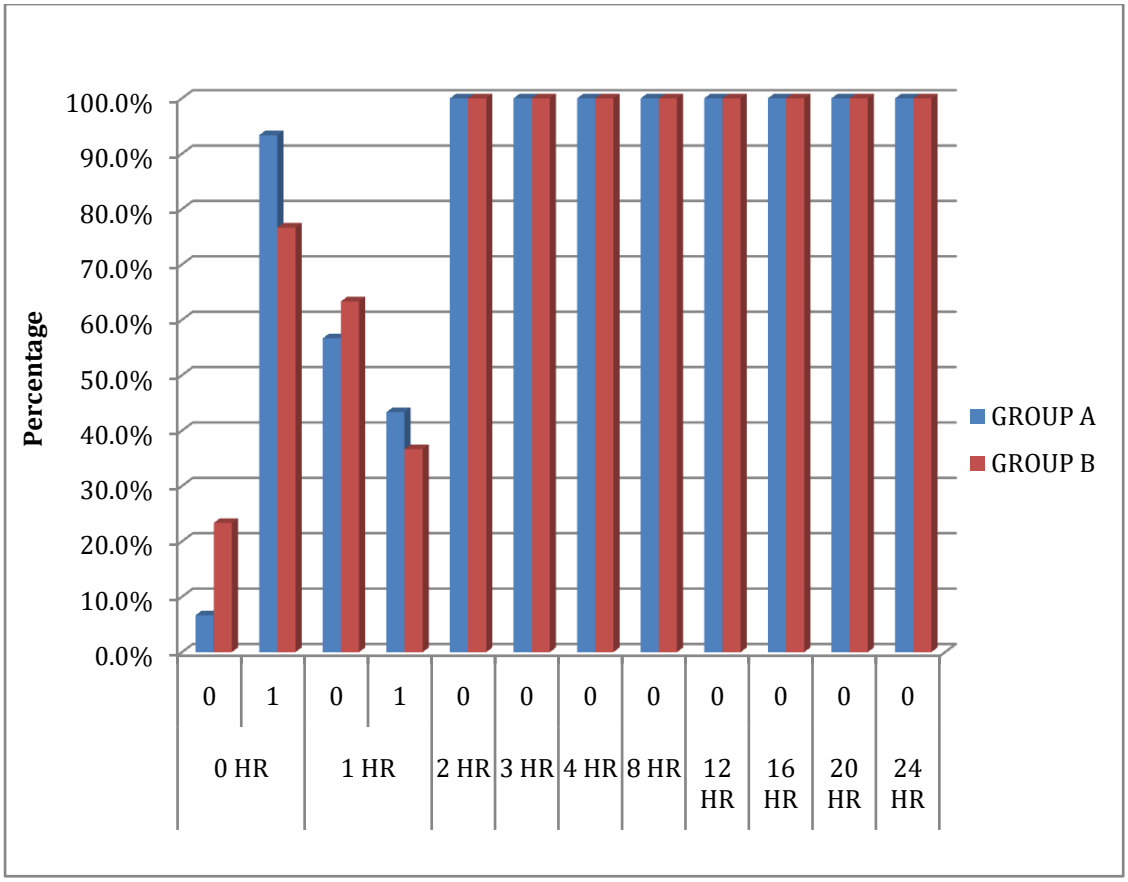


Figure 16: Modified Bromage score after shifting to PACU

The MBS score at 0 hour after shifting to PACU was statisticallyinsignificant in both the groups A and B (p value=0.142). It remained insignificant throughout the stay of the patient in PACU for first 24 hours. [Table 16, figure 16]

TABLE 17: MEAN MORPHINE CONSUMPTION AFTER SHIFTING TO PACU

	GROUP A		GROUP B		Z	p-value
	Mean	SD	Mean	SD		
MORPHINE CONSUMPTION IN 24 HR(mg)	10.33	1.27	5.00	0.00	-7.564	0.001

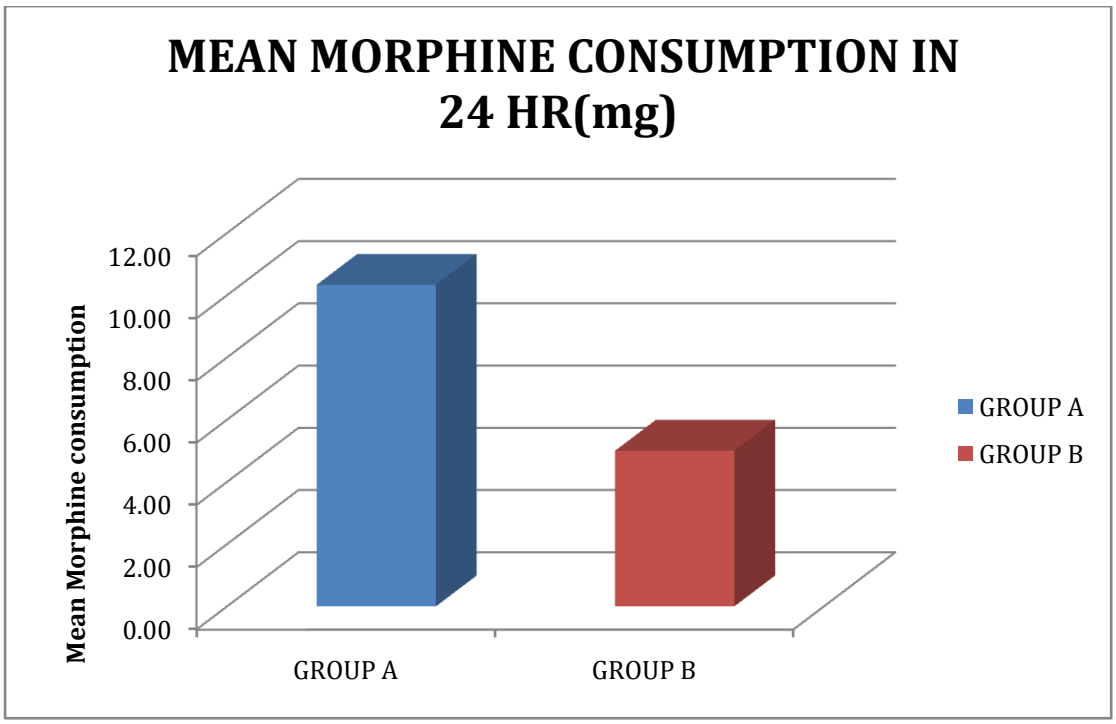


Figure 17: Mean morphine consumption after shifting to PACU

In group A, mean morphine consumption was 10.33 mg, whereas, in group B it was 5.00 mg. This value was statistically significant showing mean morphine consumption in group B to be significantly lower as compared to group A (p value= 0.001). [Table 17, Figure 17]

TABLE 18: ADVERSE EVENTS AFTER SHIFTING TO PACU

		GROUP A		GROUP B		Total	Chi-square value	p-value
		No. of cases	%age	No. of cases	%age			
ADVERSE EVENTS	NO ADVERSE EFFECTS	15	50.0%	21	70.0%	36	3.867	0.276
	HYPOTENSION	3	10.0%	2	6.7%	5		
	NAUSEA & VOMITING	10	33.3%	5	16.7%	15		
	PRURITIS	2	6.7%	2	6.7%	4		
	HEMATOMA	0	0	0	0			
	INFECTION	0	0	0	0			
Total		30	100%	30	100%	60		

In group A out of total 30 cases, 15(50.0%) cases did not have any adverse effect of analgesia, 10(33.3%) cases suffered from nausea and vomiting, 3(10.0%) cases had hypotension and 2 (6.7%) cases reported pruritis. In Group B, 21 cases (70.0%) did not experience any adverse event, however, 5 cases (16.7%) had nausea and vomiting, 2 cases (6.7%) had hypotension and 2 cases (6.7%) case were of pruritis. The appropriate treatment was given to the patients who suffered these various adverse effects. [Table 18]

DISCUSSION

Decompression of the narrow spinal canal, which can result from a number of disorders including primary and secondary spinal tumors, degenerative stenosis, fracture, abscess, and deformity, is commonly treated with laminectomy. Both the lamina and the spinous process are eliminated. Due to extensive tissue dissection, patients undergoing laminectomy experience significant pain in the immediate post-operative period. It is extremely important to manage this post-operative pain effectively as the consequences of inadequate pain treatment be devastating. [60] Untreated pain can result in sympathetic stimulationresulting intachycardia, hypertension and increased myocardial demand, predisposing patients to myocardial ischemia and infarction. 61[] Inadequate pain management can also result in hypoventilation, predisposing patients to atelectasis and pulmonary complications. In addition, it may result in poor wound healing, insomnia and delay in mobilizing the patients increasing overall costs for the patient and may even result in chronic pain. [62]

Opioids continue to remain the mainstay of postoperative pain management. Opioids bind to receptors in peripheral tissues and the central nervous system, modifying the nociceptors' effects. Oral, transdermal, parenteral, neural, and rectal administration are among the commonly used routes of administration. The most often prescribed intravenous opioids for pain following surgery are fentanyl, hydromorphone and morphine. The substantial adverse effects of all opioids restrict their use.Their major adverse effects include respiratory depression, nausea and vomiting, disorientation, retention of urine, drowsiness and itching. [34] In recent years, opioid induced hyperalgesia is an increasingly gaining awareness, prompting physicians to try and reduce peri-operative opioid use. [63]

A multimodal approach is frequently advocated nowadays, wherein,regional analgesic techniques like epidural analgesics, peripheral nerve blocks or local wound infiltration using local anesthetics are deployed in an effort to reduce the use of opioids inthe management of post-operative pain. [64]

In particular, local surgical wound infiltration with local anesthetic agents has emerged as a commonly used technique due toits ease of administration, effectiveness, safety and low cost. It requires no additional training or equipment. The commonly used local anesthetics for this purpose are bupivacaine and ropivacaine. [41]

Ropivacaine is a propyl analogue of bupivacaine and has longer duration of action as a local anesthetic. Compared to bupivacaine, ropivacaine has reduced cardiotoxicity, is less lipophilic, therefore less likely to pierce myelinated motor fiber, resulting in more selective sensory block when used in appropriate concentrations. For post operative analgesia, commonly 0.2 % ropivacaine is preferred. Research conducted in vitro demonstrates that ropivacaine also causes vasoconstriction by inducing vascular contractility, which contributes to its longer duration of action. [12]

Saini D et al. investigated the postoperative analgesic effectiveness of 20 mL of 0.25% ropivacaine in wound infiltration after lumbar laminectomy. They discovered that patients who got ropivacaine wound instillation had better pain control, a longer duration of analgesia, and a lower need for analgesics than the placebo group.[7] Similarly, Cha et al. (2011) found that utilizing 20 mL of 0.2% ropivacaine for wound infiltration could significantly reduce postoperative pain, reduce the need for additional analgesic medicine, and shorten hospital stays following abdominal surgery. [65]

Li et al conducted a retrospective study in 2020 on 112 patients undergoing lumbar fusion. The patients were divided into two groups (ropivacaine and control groups) according to whether or not, they received wound infiltration with ropivacaine. The authors reported that infiltration of the wound with 10 ml of 0.25% to 0.75% ropivacaine effectively lowered postoperative nausea and vomiting and postoperative opioid use and proved to enhance recovery in individuals having lumbar spine surgery. [55]

Continuous wound infiltration was studied in2021 by Stamenkovic et al. They observed that continuous infusion wound infiltration prolongs the duration of analgesia, reduces the requirement of analgesics and improves patient's mobilization. [41]

Epidural analgesia has been shown to be a safe and effective means of treating postoperative pain after a wide range of procedures. There is a large body of literature on its use following thoracic, lower abdominal, and lower limb procedures. Epidural analgesia has also been used after major spinal surgery, corrective scoliosis surgery, and a laminectomy. Most retrospective and prospective investigations have found benefits of epidural analgesics in terms of decreased pain scores, decreased need for opioid rescue, and increased satisfaction. [66]

Samagh et al conducted a study in 2018 to study the effect of epidural analgesia using ropivacaine following lumbosacral surgery. A total of 80 patients undergoing posterior lumbosacral spine operations were studied, with 40 patients each randomly assigned to receive ropivacaine (R) or saline (S). Patients in the R group were administered a caudal epidural injection of 20 ml of 0.2% ropivacaine for procedures at or below L5 lumbar spine, and 25 ml of 0.2% ropivacaine for surgeries between L2 and L5. Patients in the S group received comparable amounts of normal saline. Patients' pain levels were measured using a visual analogue scale (VAS) in the immediate postoperative period, as well as 4, 8, 12, and 24 hours later. Time to rescue analgesia and intraoperative fentanyl demand were measured and found to be lower in the R group, leading to the conclusion that caudal epidural injection of ropivacaine is a safe and efficient postoperative analgesic. [11]

Tosi et al. conducted a study in 2020 to evaluate the efficacy of continuous epidural analgesia with ropivacaine solution as an adjuvant treatment after posterior thoracolumbar interbody fusion. Thirty-three patients undergoing spinal fusion surgery were randomly assigned to two groups. One group received a continuous epidural infusion of 0.9% saline. The other group was given a continuous epidural infusion of 0.2% ropivacaine solution. The major end measure was the patients' pain level, measured using the visual analogue scale (VAS). It was concluded that continuous epidural ropivacaine infusion after posterior thoracolumbar spinal fusion surgery improved postoperative VAS ratings and led to a faster hospital discharge. [67]

As can be seen from the statistics above, both local wound infiltration and epidural injection of local anesthetics have been shown to be beneficial after spine surgery.[41] However, while searching the literature, we were unable to locate a trial comparing the analgesic efficacy of epidural versus local wound infiltration of local anesthetic following laminectomy surgery. The goal of this study was to address a knowledge gap by comparing the analgesic efficacy of local wound infiltration with local anesthetic to epidural instillation.

Zaric et al. examined the effects of 0.1%, 0.2%, and 0.3% ropivacaine, as well as 0.25 percent bupivacaine. Motor block was modest with 0.1% ropivacaine, allowing for subject movement. It was modest with 0.2 and 0.3% ropivacaine, but the most intense was with 0.25% bupivacaine. The authors recommended 0.2% to avoid hemodynamic instability and motor obstruction. For the purposes of this investigation, we used ropivacaine at a concentration of 0.2%. Motor obstruction caused by epidural analgesia after spinal surgery is extremely undesired since it may not delay mobilization and hide the symptoms in the uncommon occurrence of postoperative epidural hematoma formation. [59]

Meanwhile, Blumenthal et al. used 0.3% epidural ropivacaine while comparing the effectiveness of intravenous morphine with epidural ropivacaine for pain following scoliosis surgery. However, higher concentrations of local anesthetics run the risk of motor blockage, which as has been mentioned above is highly undesirable following spine surgery. [58]

The current study involved sixty adult patients, of either gender, aged 18 to 65 years, classified as ASA grades I, II, and III, who were scheduled to have lumbar laminectomy under general anesthesia. As can be seen in the consort diagram (figure 1), all the enrolled patients completed the study and there were no exclusions. The demographic data which included patients' age, gender, height, weight, and ASA physical status were similar across all groups. This is important because the demographic characteristics can have a bearing on the incidence and severity of pain perception. Shmagel et al

reported an increased incidence of pain with increasing age and in females following spine surgeries. [68]

Both groups had similar average baseline heart rates. However, at 12 and 16 hours, Group A had considerably higher heart rates than Group B individuals. Furthermore, the mean arterial pressure (MAP) was statistically insignificant during the time period, with the exception of 12 hours (p=0.021). Kumar et al. examined these findings in a 2022 study on wound infiltration and instillation approach for postoperative analgesia in lumbar spine surgeries, in which group A received locally infiltrated bupivacaine and group B received 0.25% bupivacaine in paravertebral muscles. The study found no statistically significant difference in heart rate and MAP between the two groups at any time periods. [37]

For the majority of the time periods, the difference in mean systolic blood pressure (SBP) in both groups were statistically insignificant. When comparing group A (local wound infiltration with 0.2% ropivacaine) to group B (epidural instillation of 0.2% ropivacaine), the mean SBP was found to be lower in group B at 12 hr, 16 hr, and 20 hr. This difference was statistically significant. Similar to this, the DBP in both groups remained insignificant at the majority of time intervals, with the exception at1 and 12 hour time interval between group A and B, when the difference with DBP lower in group B at one hour and twelve hours. Bindra et al in their study in 2017 showed that at all periods, there was no statistically significant difference between the two groups' mean arterial pressure, mean diastolic blood pressure, mean systolic blood pressure, or intraoperative heart rate. The similar hemodynamic profile in both the groups is re-assuring and suggests that post operative pain was controlled adequately in both the groups as it is a well-documented fact that untreated pain triggers sympathetic response resulting in tachycardia and hypertension.[47]

Pain is often assessed using patient self-report methods. The visual analogue scale (VAS) is a psychometric response scale used to rate pain intensity. The simplest VAS is a straight horizontal line of a given length, usually 100 mm.

The ends are specified as the extreme limits of the parameter to be measured (symptom, pain, health), orientated left to right (worst to best). Photocopying can modify line length, making this susceptible to both random and systematic errors during completion or measurement. [69] The numeric rating scale (NRS) is a pain screening tool that uses a 0-10 scale to quantify pain severity at any given time, with zero representing "no pain" and 10 representing "the worst pain imaginable".
Compared to the VAS, it is easier to complete, faster to score, and less prone to measurement errors. [70] We preferred to use NRS in the present study.

In the current research, the mean NRS was significantly lower at most time intervals in group B in the post operative period suggesting a better pain control. However, the NRS at three, four, and eight hours was similar in both the groups. Local anesthetic infiltration at the site of a surgical wound has been observed to have favorable results on post operative pain management in many of the earlier studies. Saini D et al in their prospective study in 2018 reported good post-operative pain control in patients undergoing lumbar spine surgery who received wound instillation with 20 ml of 0.25% ropivacaine. [7]

Similarly, Sun JX et al. conducted a prospective research on 56 patients to evaluate local wound infiltration with ropivacaine for postoperative pain after open hepatectomy. The VAS scores at rest and during movement after 24 and 48 hours were similar between the two groups. The ropivacaine group had significantly lower VAS scores at 0, 6, and 12 hours than the control group. The ropivacaine group had significantly lower MAP and HR at 6, 12, and 24 hours ($P < 0.05$), shorter time to bowel recovery and length of hospitalization following surgery, and lower cumulative sufentanil intake at 6, 12, 24, and 36 hours than the control group. It was determined that infusing the wound with ropivacaine after open hepatectomy can alleviate pain and reduce surgical stress and speed up recovery. [71]

Lee et al in 2020 examined the effectiveness of continuous local infiltration at an abdominal surgical site in patients undergoing anterior lumbar interbody fusion surgery in a study. Of the 61 patients, 31 were administered local

anesthetic infiltration at the abdominal site. Patients reported less pain using the VAS score at the surgery site during rest and movement at 0, 12, 24, and 48 hours. Additionally, they were more satisfied with pain control therapy at the first postoperative day and week compared to the control group. [26]

Epidural analgesia using local anesthetics is a well established technique for post-operative pain treatment, potentially improving patient outcomes. Balancing motor block and analgesia is a fundamental difficulty in epidural analgesia. [66] This is achieved using appropriate concentration of local anesthetic solution (0.2% ropivacaine in the present study).

Gottschalk et al examined the effects of epidural ropivacaine 0.1% versus placebo and reported a decrease in postoperative VAS scores in 2004. This study included 30 patients undergoing significant lumbar spinal surgery using a dorsal technique.

Before closing the wound, the orthopedic surgeon placed an epidural catheter. Patients were randomly randomized to receive an infusion of 12 ml/h ropivacaine, 0.1% (group R) or 12 ml/h saline (group N) following an initial bolus of 10 ml of the study solution. An intravenous pump containing piritramide, an opioid, was used to offer additional pain relief. Patients were evaluated for pain scores (VAS), opioid use, side effects, and satisfaction with pain treatment. It was concluded that continuous epidural infusion of 0.1% ropivacaine reduces pain, narcotic usage, and improves patient satisfaction when compared to placebo. The administration of ropivacaine through an epidural catheter appears to be a particularly effective treatment for postoperative pain after major lumbar spine surgery. [72]

Samagh et al conducted a study in 2018 in which eighty patients undergoing lumbosacral spine operations via the posterior route were randomly assigned to two groups: ropivacaine (R) (n = 40) or saline (S). Patients in the R group were given a caudal epidural injection of 20 ml of 0.2% ropivacaine for procedures at or below the L5 lumbar spine, and 25 ml of 0.2% ropivacaine for surgeries between the L2 and L5 lumbar spine. Patients in the S group

received comparable amounts of normal saline. Patients were assessed for pain using a visual analogue scale (VAS) in the immediate postoperative period as well as at 4, 8, 12, and 24 hours later. Time to rescue analgesia and intraoperative fentanyl demand were recorded. The R group had significantly decreased mean intraoperative fentanyl demand and mean VAS scores in the immediate postoperative period and next 24 hours. The mean time elapsed from the initial demand of rescue analgesia was substantially longer in the R group than in the S group. [11]

In 2020, Zhang et al did a study to test epidural anesthesia with low concentration ropivacaine and sufentanil for percutaneous transforaminal endoscopic discectomy for the treatment of lumbar intervertebral disc herniation. Two hundred patients were randomly assigned to receive 10 ml of 0.125% ropivacaine for epidural anesthesia or local infiltration anesthesia. The primary outcome indicators were pain score and patient satisfaction. Compared to the local anesthesia group, it was seen that the epidural anesthesia group had significantly lower visual analog scale ratings, mean arterial pressure, and heart rate and patients were more satisfied. [73]

Hermans et al conducted a meta-analysis in 2021 to study intraoperative epidural analgesia for pain relief after lumbar decompressive spine surgery. Eight studies that assessed the efficacy of intraoperative epidural analgesia were included. Seven studies found statistically significant reductions in postoperative VAS pain scores. Six studies found a statistically significant decrease in postoperative analgesic intake. It was observed that the time to first analgesic requirement following surgery was likewise significantly longer in the treatment groups, and the meta-analysis revealed a statistically significant difference in the duration at which analgesic was required. It was found that administering additional epidural nonsteroidal analgesia as a bolus after decompressive spine surgery can reduce postoperative pain and analgesic use. [74]

In the current trial, group A showed mean morphine consumption of 10.33±1.27 mg, whereas, in group B it was 5.00 ± 0.0 mg. This difference was statistically significant with mean morphine consumption in group B to be significantly lower as compared to group A. This data suggests that 0.2% ropivacaine administered via epidural instillation was superior to 0.2% ropivacaine infused locally into wound. In a study on the efficacy of wound infusion of 0.5% ropivacaine for postoperative analgesia, Forastiere et al in 2008 demonstrated that the infiltration of ropivacaine during open nephrectomy increased pain relief. Morphine consumption was substantially higher in the control group as compared to group which received ropivacaine. [75]

In the current study, a number of adverse effects were observed in the post-operative period. The incidence of adverse effects was, however similar in both the groups. The common adverse effects noted were nausea and vomiting, hypotension and pruritis. Nausea, vomiting and pruritis may be ascribed to the use of morphine for break through pain. The similar incidence of hypotension among the two groups is an important observation and suggests that 20 ml of 0.2% ropivacaine administered in epidural space did not cause any significant hypotension in the post operative period. Epidural local anesthetics have the potential to cause hypotension due to vasodilatation resulting from sympathetic blockade. The stable hemodynamic profile may be explained by the fact that a dilute solution concentration (0.2 % ropivacaine) was used. Kundra et al in a study conducted in 2014 studying epidural application of morphine observed a higher incidence of pruritis (46.6 %) than the present study. This difference may be explained by the fact that epidural application of opioids is more likely to result in pruritis. [76]

Moraca et al demonstrated that high doses of local anesthetics in epidural space can cause seizures, loss of airway protective reflexes, respiratory depression, coma, cardiac arrhythmias, hemodynamic instability, and motor or autonomic blockage (urinary retention, paralysis) in 0-45% of patients. Other potential complications include hypotension, bradycardia, epidural hematoma and paraplegia. [66]

In conclusion, following lumbar spinal surgery, it was observed that there was a significant decrease in the pain score and requirement of rescue analgesic in the postoperative period with the use of epidural instillation of 0.2% ropivacaine as compared to local wound infiltration of 0.2% ropivacaine.

SUMMARY AND CONCLUSION

The present study was conducted in the Department of Anaesthesia, Dayanand Medical College and Hospital, Ludhiana after approval from institutional Ethics Committee. Sixty ASA grade I, II and III patients, between 18 to 65 years of age, posted for elective lumbar laminectomy surgery under general anesthesia were enrolled for this prospective, double blind, randomized controlled trial. The patients were randomly divided into two groups of 30 patients each.

The anesthetic technique was standardized in all the study groups.

1) In group A patients, 0.2% of 10 ml ropivacaine was given as local wound instillation.
2) In group B patients, 0.2% of 10ml ropivacaine was given as epidural infiltration.

Once the surgery had been completed, the patient was shifted to PACU where the time was labelled as '0' hr.

Various hemodynamic parameters including heart rate (HR), systolic blood pressure (SBP), Diastolic blood pressure (DBP), mean oxygen saturation, respiratory rate and mean arterial pressure (MAP) were recorded at the following time intervals i.e. just after completion of local wound infiltration/epidural instillation of study drug (i.e. time '0') and every hour for first 4 hours and then four hourly for rest of the 24 hours. Incidence of pain, grade of pain, adverse effects, dose of rescue analgesic and treatment of adverse effects were also recorded.

The following conclusions were drawn during the study period:

- The patients in both the groups were comparable with respect to age, gender, weight, height, BMI and ASA physical status.
- The mean HR, SBP, DBP and MAP values after administration of study drug were comparable in majority of the time periods among group A and B.
- The respiratory rate and mean oxygen saturation after administration of study drug were comparable in both the groups.

- The mean bromage score (MBS) score at 0 hour after shifting to PACU was statistically insignificant in both the groups A and B. It remained insignificant throughout the stay of the patient in PACU for first 24 hours.
- The incidence of pain was significantly lesser in group B as compared to group A. The mean numerical rating score (NRS) at 0, 1 and 2 hours was significantly lower in group B as compared to group A.However, NRS at 3 hr, 4 hr and 8 hr was statistically similar in both the groups. Later on, NRS was significantly lower in group B as compared to group A at 12, 16, 20 and 24 hour with p values of 0.003, 0.001, 0.001 and 0.017 respectively.
- Consumption of the rescue analgesic used in the form of morphine was higher in group A in comparison to group B. No rescue analgesic was given to any patient at 0 hour after shifting to PACU. Seven patients in group A and only one patient in group B received rescue analgesic between 0 hour to 1 hour interval. Ten patients in group A and 3 patients in Group B received rescue analgesic between 1 hour to 2 hour interval. The rescue analgesic given to the patients was statistically insignificant except at 12 hour where rescue analgesic given in group B was significantly lower as compared to group A (p value=0.012).
- In group A, mean morphine consumption was 10.33 ± 1.27 mg whereas, in group B it was 5.00 ± 0.0 mg. Therefore, mean morphine consumption in group B was significantly lower as compared to group A.
- In group A out of total 30 cases, 15(50.0%) cases did not have any adverse effect of analgesia, 10(33.3%) cases suffered from nausea and vomiting, 3(10.0%) cases had hypotension and 2 (6.7%) cases reported pruritis. In Group B, 21 cases (70.0%) did not experience any adverse event, however, 5 cases (16.7%) had nausea and vomiting, 2 cases (6.7%) had hypotension and 2 cases(6.7%) case were of pruritis.

Hence, we conclude that pain scores and requirement of rescue analgesia in the form of morphine was significantly reduced in group B (epidural instillation of 0.2% ropivacaine) following lumbar laminectomy as compared to group A (local wound infiltration of 0.2% ropivacaine).

BIBLIOGRAPHY

1. Meissner W, Zaslansky R. A survey of postoperative pain treatments and unmet needs. Best Pract Res Clin Anaesthesiol. 2019;33:269-86.
2. Patel MK, Soren DK, Patro GSP, Patra AN, Padhan B, Parija KK, et al. Postoperative analgesic effect of wound site infiltration with bupivacaine versus ropivacaine - a randomised clinical trial at VIMSAR, Burla. J Evid Based Med Healthc 2021;8:1875-81.
3. Prabhakar NK, Chadwick AL, Nwaneshiudu C, Aggarwal A, Salmasi V, Lii TR, et al. Management of Postoperative Pain in Patients Following Spine Surgery: A Narrative Review. Int J Gen Med. 2022;15:4535-49.
4. Cheung CK, Adeola JO, Beutler SS, Urman RD. Postoperative Pain Management in Enhanced Recovery Pathways. J Pain Res.2022;15:123-35.
5. O'Lynnger TM, Zuckerman SL, Morone PJ, Dewan MC, Vasquez-Castellanos RA, Cheng JS. Trends for Spine Surgery for the Elderly: Implications for Access to Healthcare in North America. Neurosurgery. 2015;77:136-41.
6. Wang MY, Green BA, Shah S, Vanni S, Levi AD. Complications associated with lumbar stenosis surgery in patients older than 75 years of age. Neurosurg Focus. 2003;14:7.
7. Saini D, Yadav U. Study of Wound Instillation Technique for Effective Postoperative Analgesia using Ropivacaine in Lumbar Spine Surgery. Anesth Essays Res. 2018;12:685-89.
8. Patel L, Shah K, Padhiyar V, Patel K, Patel B, Pre-emptive Incision Infiltration Versus Post-Operative Wound Infiltration with 0.5% ropivacaine in Patients Undergoing Lumbar Laminectomy. ***Indian J Clin Anaesth.*** 2015;2:217-21.
9. Li C, Qu J, Pan S, Qu Y. Local infiltration anesthesia versus epidural analgesia for postoperative pain control in total knee arthroplasty: a systematic review and meta-analysis. J OrthopSurg Res. 2018;13:112.
10. Spreng UJ, Dahl V, Hjall A, Fagerland MW, Raeder J. High-volume local infiltration analgesia combined with intravenous or local ketorolac

+morphine compared with epidural analgesia after total knee arthroplasty. Br J Anaesth. 2010;105:675-82.

11. Samagh N, Pai RK, Mathews TK, Jangra K, Varma RG. Pre-emptive caudal epidural analgesia with ropivacaine for lumbosacral spine surgery: A randomized case control study. J Anaesthesiol Clin Pharmacol. 2018;34:237-41.
12. Kuthiala G, Chaudhary G. Ropivacaine: A review of its pharmacology and clinical use. Indian journal of anaesthesia. 2011;55:104-10.
13. Jayr C, Beaussier M, Gustafsson U, Leteurnier Y, Nathan N, Plaud B, et al. Continuous epidural infusion of ropivacaine for postoperative analgesia after major abdominal surgery: comparative study with i.v. PCA morphine. Br J Anaesth. 1998;81:887-92.
14. Erichsen CJ, Svojall J, Kehlet H, Hedlund C, Arvidsson T. Pharmacokinetics and analgesic effect of ropivacaine during continuous epidural infusion for postoperative pain relief. *Anesthesiology* 1996;84:834-42.
15. LiverTox: Clinical and Research Information on Drug-Induced Liver Injury [Internet]. Bethesda (MD): National Institute of Diabetes and Digestive and Kidney Diseases; 2012
16. Lee SM, Yun DJ, Lee SH, Lee HC, Joeng KH. Continuous wound infiltration of ropivacaine for reducing of postoperative pain after anterior lumbar fusion surgery: a clinical retrospective comparative study. Korean J Pain. 2021;34:193-200.
17. Gan TJ, Habib AS, Miller TE, White W, Apfelbaum JL. Incidence, patient satisfaction, and perceptions of post-surgical pain: results from a US national survey. Curr Med Res Opin 2014;30:149-60.
18. Gerbershagen HJ, Aduckathil S, van Wijck AJ, Peelen LM, Kalkman CJ, Meissner W. Pain intensity on the first day after surgery: a prospective cohort study comparing 179 surgical procedures. Anesthesiology 2013;118:934-44.
19. Sommer M, de Rijke JM, van Kleef M, Kessels AG, Peters ML, Geurts JW, et al. The prevalence of postoperative pain in a sample of 1490 surgical inpatients. Eur J Anaesthesiol 2008;25:267-74.

20. Cross SA. Pathophysiology of pain. InMayo Clinic Proceedings 1994; 69:375-83.
21. Brennan TJ. Pathophysiology of postoperative pain. Pain.2011;152:33-40.
22. Besson JM, Chaouch A. Peripheral and spinal mechanisms of nociception. Physiol Rev. 1987;67:67-186.
23. Horn R, Hendrix JM, Kramer J. Postoperative Pain Control. [Updated 2024 Jan 30]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan.
24. Lovich-Sapola J, Smith CE, Brandt CP. Postoperative pain control. Surg Clin North Am. 2015;95:301-18
25. Bianconi M, Ferraro L, Ricci R, Zanoli G, Antonelli T, Giulia B, et al. The pharmacokinetics and efficacy of ropivacaine continuous wound instillation after spine fusion surgery. AnesthAnalg. 2004;98:166-72.
26. Lee BH, Moon SH, Suk KS, Kim HS, Yang JH, Lee HM. Lumbar Spinal Stenosis: Pathophysiology and Treatment Principle: A Narrative Review. Asian Spine J. 2020;14:682-93.
27. Kwon JW, Moon SH, Park SY, Park SJ, Park SR, Suk KS, et al. Lumbar Spinal Stenosis: Review Update 2022. Asian Spine J. 2022;16:789-98.
28. Haefeli M, Elfering A. Pain assessment. Eur Spine J. 2006;15:17-24.
29. Closs SJ, Barr B, Briggs M, Cash K, Seers K. A comparison of five pain assessment scales for nursing home residents with varying degrees of cognitive impairment. J Pain Symptom Manage 2004;27:196-205.
30. Farrar JT, Portenoy RK, Berlin JA, Kinman JL, Strom BL. Defining the clinically important difference in pain outcome measures. Pain 2000;88:287-94.
31. Prkachin KM, Schultz I, Berkowitz J, Hughes E, Hunt D. Assessing pain behaviour of low-back pain patients in real time: concurrent validity and examiner sensitivity. Behav Res Ther. 2002;40:595-607.
32. Lespasio MJ, Guarino AJ, Sodhi N, Mont MA. Pain Management Associated with Total Joint Arthroplasty: A Primer. Perm J. 2019;23:18-169.
33. Thurston KL, Zhang SJ, Wilbanks BA, Billings R, Aroke EN. A Systematic Review of Race, Sex, and Socioeconomic Status Differences in

Postoperative Pain and Pain Management. J PerianesthNurs. 2023;38:504-15.

34. Garimella V, Cellini C. Postoperative pain control. Clin Colon Rectal Surg. 2013;26:191-6.
35. Walcott BP, Khanna A, Yanamadala V, Coumans JV, Peterfreund RA. Cost analysis of spinal and general anesthesia for the surgical treatment of lumbar spondylosis. J Clin Neurosci. 2015;22:539-43.
36. Peene L, Le Cacheux P, Sauter A, Joshi GP, Beloeil H. Pain management after laminectomy: a systematic review and procedure-specific post-operative pain management (PROSPECT) recommendations, *Regional Anesthesia& Pain Medicine* 2021;70**:**111-12.
37. Kumar M, Srivastava S, Singh D, Yadav JBS, Kumar V. Wound Infiltration and Instillation Technique for Postoperative Analgesia Using Bupivacaine in Patients Undergoing Lumbar Spine Surgeries. Cureus. 2022 Mar 28;14:23592.
38. Simpson D, Curran MP, Oldfield V, Keating GM. Ropivacaine: A review of its use in regional anaesthesia and acute pain management. Drugs 2005;65:2675-17.
39. Burm AG, Stienstra R, Brouwer RP, Emanuelsson BM, van Kleef JW. Epidural infusion of ropivacaine for postoperative analgesia after major orthopedic surgery: Pharmacokinetic evaluation. Anesthesiology 2000;93:395-403.
40. Hernández-Palazón J, Tortosa Serrano JA, Burguillos López S, Molero Molero E: Infiltration of the surgical wound with local anesthetic for postoperative analgesia in patients operated on for lumbar disc herniation. Comparative study of ropivacaine and bupivacaine (Article in Spanish). Rev Esp AnestesiolReanim. 2001;48:17-20.
41. Stamenkovic DM, Bezmarevic M, Bojic S, Unic-Stojanovic D, Stojkovic D, Slavkovic DZ, et al. Updates on Wound Infiltration Use for Postoperative Pain Management: A Narrative Review. J Clin Med. 2021;10:4659.
42. Kong TW, Park H, Cheong JY, Min SK, Ryu HS. Efficacy of continuous wound infiltration of local anesthetic for pain relief after gynecologic laparoscopy. Int J Gynaecol Obstet. 2014;124:212-5.

43. Altuntaş G, Akkaya ÖT, Özkan D, Sayın MM, Balas Ş, Özlü E: Comparison of intraabdominal and trocar site local anaesthetic infiltration on postoperative analgesia after laparoscopic cholecystectomy. Turk J AnaesthesiolReanim. 2016, 44:306-11.
44. Vigneau A, Salengro A, Berger J, Rouzier R, Barranger E, Marret E, et al. A double blind randomized trial of wound infiltration with ropivacaine after breast cancer surgery with axillary nodes dissection. BMC Anesthesiol. 2011;11:23.
45. Kakagia D, Fotiadis S, Tripsiannis G. Comparative efficacy of ropivacaine and bupivacaine infiltrative analgesia in otoplasty. Ann Plast Surg. 2005;54:409-11.
46. Fayman M, Beeton A, Potgieter E, Becker PJ. Comparative Analysis of Bupivacaine and Ropivacaine for Infiltration Analgesia for Bilateral Breast Surgery. 2003;100-1.
47. Bindra TK, Kumar P, Rani P, Kumar A, Bariar H. Preemptive Analgesia by Intraperitoneal Instillation of Ropivacaine in Laparoscopic Cholecystectomy. Anesth Essays Res. 2017;11:740-44.
48. Hernández-Palazón J, Tortosa JA, Rosa V, Giménez-Viudes J, Ramírez G, Robles R. Intraperitoneal application of Bupivacaine plus morphine for pain relief after laparoscopic cholecystectomy. Eur J Anaesthesiol. 2003;20:891-6.
49. Xu B, Ren L, Tu W, Wu Z, Ai F, Zhou D, et al. Continuous wound infusion of ropivacaine for the control of pain after thoracolumbar spinal surgery: a randomized clinical trial. Eur Spine J. 2017;26:825-31.
50. Adesope O, Ituk U, Habib AS. Local anaesthetic wound infiltration for postcaesarean section analgesia: A systematic review and meta-analysis. Eur J Anaesthesiol. 2016;33:731-42.
51. Block BM, Liu SS, RowlingsonAJ, Cowan AR, Cowan JA Jr, Wu CL. Efficacy of postoperative epidural analgesia: a meta-analysis. JAMA. 2003;290:2455-63.
52. Li JW, Ma YS, Xiao LK. Postoperative Pain Management in Total Knee Arthroplasty.Orthop Surg. 2019;11:755-61.
53. Ventham NT, Hughes M, O'Neill S, Johns N, Brady RR, Wigmore SJ. Systematic review and meta-analysis of continuous local anesthetic

wound infiltration versus epidural analgesia for postoperative pain following abdominal surgery. Br J Surg. 2013;100:1280-9.

54. Mehta S, Gajbhare MN, Kamble NP. Comparison of Epidural Analgesia Using 0.2% Bupivacaine and 0.2% Ropivacaine for the Management of Postoperative Pain in Major Orthopedic Surgery. Anesth Essays Res. 2018;12:586-91.
55. Li K, Ji C, Luo D, Feng H, Yang K, Xu H. Wound infiltration with ropivacaine as an adjuvant to patient controlled analgesia for transforaminal lumbar interbody fusion: a retrospective study. BMC anesthesiology. 2020;20:1-7.
56. Benyahia NM, Verster A, Saldien V, Breebaart M, Sermeus L, Vercauteren M. Regional anaesthesia and postoperative analgesia techniques for spine surgery - a review. Rom J Anaesth Intensive Care. 2015;22:25-33.
57. Das A, Majumdar S, Halder S, Chattopadhyay S, Pal S, Kundu R, et al. Effect of dexmedetomidine as adjuvant in ropivacaine-induced supraclavicular brachial plexus block: A prospective, double-blinded and randomized controlled study. Saudi J Anaesth. 2014;8:72-7.
58. Blumenthal S, Min K, Nadig M, Borgeat A. Double epidural catheter with ropivacaine versus intravenous morphine: a comparison for postoperative analgesia after scoliosis correction surgery. Anesthesiology. 2005;102:175-80.
59. Zaric D, Axelsson K, Nydahl PA, Philipsson L, Larsson P, Jansson JR. Sensory and motor blockade during epidural analgesia with 1%, 0.75%, and 0.5% ropivacaine – a double-blind study. AnesthAnalg 1991;72:509-15.
60. Prabhakar NK, Chadwick AL, Nwaneshiudu C, Aggarwal A, Salmasi V, Lii TR, et al. Management of Postoperative Pain in Patients Following Spine Surgery: A Narrative Review. Int J Gen Med. 2022;15:4535-49.
61. Huffman JC, Pollack MH, Stern TA. Panic Disorder and Chest Pain: Mechanisms, Morbidity, and Management. Prim Care Companion J Clin Psychiatry. 2002;4:54-62.
62. Gan TJ. Poorly controlled postoperative pain: prevalence, consequences, and prevention. J Pain Res. 2017 ;10:2287-98.

63. U.S. Department of Health and Human Services (2019, May). Pain Management Best Practices Inter-Agency Task Force Report: Updates, Gaps, Inconsistencies, and Recommendations. Retrieved from U. S. Department of Health and Human.
64. Chen YK, Boden KA, Schreiber KL. The role of regional anaesthesia and multimodal analgesia in the prevention of chronic postoperative pain: a narrative review. Anaesthesia. 2021;76:8-17.
65. Cha SM, Kang H, Baek CW, ung YH, Koo GH, Kim BG, et al.: Peritrocal and intraperitoneal ropivacaine for laparoscopic cholecystectomy: a prospective, randomized, double-blind controlled trial. J Surg Res. 2012;175:251-8.
66. Moraca RJ, Sheldon DG, Thirlby RC. The role of epidural anesthesia and analgesia in surgical practice. Ann Surg. 2003;238:663-73.
67. Tosi, Maurizio & Bhutia, Jigme &Scholliers, Annelies &Raeymaeckers, Steven & Forget, Patrice & Matic, M. & Van Schaik, David &Eynde, S. &Opsomer, T. & Silva, P. &Poelaert, J.. (2020). Epidural ropivacaine infusion as part of a multimodal postoperative pain treatment following thoracolumbar spinal fusion surgery, a randomised controlled trial. Acta anaesthesiologica Belgica. 197-201.
68. Shmagel A, Foley R, Ibrahim H. Epidemiology of Chronic Low Back Pain in US Adults: Data From the 2009-2010 National Health and Nutrition Examination Survey. Arthritis Care Res (Hoboken). 2016;68:1688-94.
69. Klimek L, Bergmann KC, Biedermann T, Bousquet J, Hellings P, Jung K, et al. Visual analogue scales (VAS): Measuring instruments for the documentation of symptoms and therapy monitoring in cases of allergic rhinitis in everyday health care: Position Paper of the German Society of Allergology (AeDA) and the German Society of Allergy and Clinical Immunology (DGAKI), ENT Section, in collaboration with the working group on Clinical Immunology, Allergology and Environmental Medicine of the German Society of Otorhinolaryngology, Head and Neck Surgery (DGHNOKHC). Allergo J Int. 2017;26:16-24.
70. Madden VJ, Kamerman P, Leake HB, Catley MJ, Heathcote LC, Moseley GL. The Sensation and Pain Rating Scale: easy to use, clear to interpret, and responsive to clinical change. MedRxiv. 2023.

71. Sun JX, Bai KY, Liu YF, Du G, Fu ZH, Zhang H, et al. Effect of local wound infiltration with ropivacaine on postoperative pain relief and stress response reduction after open hepatectomy. World J Gastroenterol. 2017;23:6733-40.
72. Gottschalk A, Freitag M, Tank S, Burmeister MA, Kreil S, Kothe R, et al. Quality of postoperative pain using an intraoperatively placed epidural catheter after major lumbar spinal surgery. Anesthesiology. 2004;101:175-80.
73. Zhang L, Chang T, Xu Y, Jing Q, Zhao X, Li C. Epidural AnesthesiaWith Low Concentration Ropivacaine and Sufentanil for Percutaneous Transforaminal Endoscopic Discectomy: A Randomized Controlled Trial. Front Med (Lausanne). 2020;7:362.
74. Hermans SM, Lantinga-Zee AA, Rijkers K, van Santbrink H, van Hemert WL, Reinders MK, et al. Intraoperative epidural analgesia for pain relief after lumbar decompressive spine surgery: A systematic review and meta-analysis. Brain and Spine. 2021;1:100306..
75. Forastiere E, Sofra M, Giannarelli D, Fabrizi L, Simone G. Effectiveness of continuous wound infusion of 0.5% ropivacaine by On-Q pain relief system for postoperative pain management after open nephrectomy. Br J Anaesth. 2008;101:841-7.
76. Kundra S, Gupta V, Bansal H, Grewal A, Katyal S, Choudhary AK. Comparative study of epidural application of morphine versus gelfoam soaked in morphine for lumbar laminectomy. Journal of Anaesthesiology Clinical Pharmacology. 2014;30:46-52.

KEY TO MASTER CHART

M	Male
F	Female
PIVD	Prolapsed Intervertebral disc
BMI	Body mass index
ASA	American Society of Anesthesiologists
SBP	Systolic Blood Pressure
DBP	Diastolic Blood Pressure
PACU	Post anesthesia care unit
MAP	Mean arterial pressure
SpO_2	Saturation of peripheral oxygen
RR	Respiratory rate
NRS	Numeric rating scale
MBS	Modified bromage score
NA	Not applicable

S NO.	RANDOMIZATION NUMBER	MRD NO.	NAME	AGE (years)	GENDER	DIAGNOSIS	SURGERY PERFORMED	Mode of drug administration	GROUP	WEIGHT (Kg)	HEIGHT (cm)	BMI (kg/m2)	ASA	DURATION OF SURGERY (IN MINUTES)	DURATION OF ANESTHESIA (MINUTES)	HEART RATE_0 HOUR	HEART RATE_1 HOUR	HEART RATE_ HOUR	HEART RATE_3 HOUR	HEART RATE_4 HOUR	HEART RATE_8 HOUR	HEART RATE_12 HOUR	HEART RATE_16 HOUR	HEART RATE_20 HOUR	HEART RATE_24 HOUR	SBP_AFTER SHIFTING TO PACU 0 HOUR	SBP_1 HOUR	SBP_2 HOUR	SBP_3 HOUR
1	1	394416	JS	66	M	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	68	170	23.5	II	240	260	75	89	80	82	92	84	80	75	74	74	120	140	125	124
2	2	435852	RS	58	M	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	72	172	24.1	II	240	260	80	82	85	95	85	82	96	85	82	80	120	125	145	130
3	3	1431693	SS	38	M	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	69	168	24.6	II	230	250	80	82	85	95	85	82	96	85	82	80	120	125	130	145
4	4	1431693	GS	49	M	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	80	175	26	II	235	255	80	82	85	95	80	82	85	82	82	80	110	115	125	140
5	5	1403322	CS	52	M	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	79	167	28.1	II	230	250	69	72	72	73	75	90	82	80	75	72	110	112	115	125
6	6	208976	RS	53	M	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	75	172	25.1	II	235	255	80	75	76	76	78	80	95	85	80	75	120	125	115	120
7	7	1441526	GS	45	M	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	75	167	26.7	II	240	260	75	72	74	85	80	90	96	90	80	75	110	112	115	135
8	8	422586	HK	62	M	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	90	172	30.2	II	240	260	75	80	85	92	88	105	90	87	85	80	110	115	130	145
9	9	1471889	RR	65	F	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	68	162	25.7	II	240	260	80	82	85	110	90	85	85	82	80	80	110	115	125	145
10	10	147743	PS	44	M	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	72	172	24.1	II	235	255	85	87	97	110	97	90	87	85	82	82	110	115	125	140
11	11	1431795	SB	67	F	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	96	162	36	II	230	250	85	87	90	97	110	98	95	87	85	85	110	113	115	125
12	12	1415680	MS	55	M	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	70	170	24.2	III	230	250	80	82	85	95	90	85	82	80	80	78	110	115	130	139
13	13	1407528	PK	50	F	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	80	162	30.3	II	235	255	80	82	85	90	95	110	102	90	85	82	110	115	125	130
14	14	1489005	PS	58	M	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	76	170	26.2	II	235	255	75	80	85	90	85	88	92	86	82	80	120	130	129	145
15	15	1007616	DG	25	F	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	65	160	25.4	I	240	260	80	82	85	90	110	90	90	82	82	80	115	115	125	130
16	16	1475540	BK	42	F	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	70	165	25.7	III	240	260	82	88	95	105	90	95	102	85	80	80	115	118	130	145
17	17	1466863	KS	29	M	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	82	177	26.2	I	240	260	82	88	90	95	100	105	96	92	85	82	115	120	125	135
18	18	1427405	GS	49	M	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	82	167	29.2	II	235	255	85	90	95	102	92	86	85	83	82	82	130	135	140	155
19	19	208976	RS	53	M	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	75	165	27.5	II	235	255	80	85	88	90	99	92	88	85	84	82	120	130	140	145
20	20	1402274	RN	31	M	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	70	172	23.5	I	235	255	82	85	90	95	98	105	100	95	86	82	125	130	135	140
21	21	152435	SK	48	M	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	71	167	25.3	II	240	260	89	85	99	90	102	89	86	84	82	80	120	130	145	140
22	22	1323475	GS	58	M	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	80	170	27.6	II	240	260	82	85	90	95	98	110	90	85	82	82	120	130	140	145
23	23	1336402	RK	54	F	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	91	165	33	II	240	260	80	95	105	96	103	110	96	92	85	80	125	135	145	135
24	24	1325917	PS	51	F	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	65	162	24.6	II	235	255	80	82	90	98	92	101	94	86	82	80	120	125	130	142
25	25	1587848	GK	58	F	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	64	162	24.2	II	235	255	80	85	90	100	90	92	98	90	85	80	120	130	135	146
26	26	1564283	AA	31	M	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	85	170	29.3	II	235	255	80	85	98	90	92	105	95	90	85	80	125	130	150	130
27	27	1396483	SS	62	M	LUMBAR CANAL STENOSIS	LAMINECTOMY	EPIDURAL INSTILLATION	2	75	170	25.9	II	235	255	82	85	90	92	97	105	95	85	82	80	125	130	135	140
28	28	1381362	HS	40	M	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	65	167	23.1	II	235	255	82	85	97	103	92	86	84	82	80	80	120	130	135	145
29	29	1362746	KS	19	M	DORSAL SPINE FIXATION	LAMINECTOMY	EPIDURAL INSTILLATION	2	60	167	21.3	I	230	250	82	85	95	106	92	86	85	83	82	82	130	135	140	146
30	30	1426888	OS	44	M	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	87	170	30	II	230	250	85	95	105	92	90	98	95	90	85	80	130	135	150	140
31	31	1588953	NK	42	F	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	65	157	26.2	II	230	250	82	92	87	95	90	84	82	80	80	78	115	122	118	139
32	32	1311338	HK	61	F	LUMBAR CANAL STENOSIS	LAMINECTOMY	WOUND INFILTRATION	1	62	154	25.8	II	230	250	75	76	76	90	85	80	92	82	80	80	115	110	116	135
33	33	1638209	DS	60	M	LUMBAR CANAL STENOSIS	LAMINECTOMY	EPIDURAL INSTILLATION	2	70	170	24.2	III	240	260	60	62	62	65	88	80	75	72	68	65	110	112	110	120
34	34	1695120	KS	64	F	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	81	154	33	III	240	260	83	93	88	95	90	84	82	81	81	78	116	120	118	140
35	35	1708852	MT	40	F	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	65	160	25.4	II	240	260	82	85	84	85	88	97	87	86	84	84	111	112	110	115
36	36	1709971	JT	39	F	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	58	162	21.2	I	240	260	82	85	95	90	84	82	82	80	80	80	110	125	140	135
37	37	1709742	AK	49	F	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	65	160	25.4	II	240	260	83	93	86	95	90	97	85	82	80	80	110	135	125	140
38	38	1704829	TS	54	M	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	80	170	27.6	II	240	260	79	90	80	78	75	73	72	72	72	72	120	140	130	125
39	39	1678564	HS	52	M	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	75	170	25.9	II	240	260	80	85	95	90	84	92	83	82	81	80	115	122	140	130
40	40	1475540	BK	42	M	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	72	165	26.4	II	240	260	83	93	88	95	90	84	82	81	81	78	116	130	120	140
41	41	1665849	SB	52	F	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	62	162	23.5	II	235	255	82	89	92	98	103	95	86	84	82	82	130	135	138	140
42	42	1708037	RK	26	F	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	60	160	23.4	I	235	255	80	82	85	90	94	98	90	85	82	80	120	130	130	135
43	43	1707508	SR	46	M	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	62	165	22.7	II	235	255	75	80	82	85	88	99	90	88	85	82	125	130	135	140
44	44	1695120	KS	65	F	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	60	157	24.2	III	235	255	65	68	80	75	72	70	68	65	65	65	122	130	140	130
45	45	1710948	BK	40	F	LUMBAR CANAL STENOSIS	LAMINECTOMY	WOUND INFILTRATION	1	66	162	25	II	235	255	80	85	97	105	90	94	99	88	85	82	130	135	140	150
46	46	1713252	SS	34	M	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	72	167	25.6	II	235	255	80	82	88	97	85	84	83	83	82	80	130	135	140	147
47	47	1695154	AG	57	M	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	70	167	24.9	II	235	255	80	85	89	99	98	96	102	95	87	85	120	125	135	140
48	48	1618628	GS	35	M	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	82	175	26.7	II	230	250	85	88	92	99	94	105	90	87	85	85	130	135	140	150
49	49	1714323	LP	55	F	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	65	162	24.6	II	230	250	75	82	85	90	85	100	90	85	80	75	110	120	135	140
50	50	1698933	SK	60	F	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	65	160	25.4	II	230	250	82	88	95	105	92	88	86	84	82	82	120	130	135	146
51	51	1700464	AJ	19	M	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	70	170	24.2	I	240	260	80	85	90	95	110	92	86	84	82	82	120	130	135	140
52	52	1700555	RV	32	M	LUMBAR CANAL STENOSIS	LAMINECTOMY	WOUND INFILTRATION	1	72	172	24.1	I	240	260	82	85	90	110	92	95	115	90	85	80	120	130	135	145
53	53	426962	JK	55	F	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	66	162	25	II	240	260	85	95	105	92	95	110	92	98	85	80	125	130	145	135
54	54	1620194	JR	62	F	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	65	165	23.8	III	240	260	85	89	102	90	90	86	84	83	82	82	120	125	146	135
55	55	1615524	AK	52	M	PIVD	LAMINECTOMY	EPIDURAL INSTILLATION	2	72	170	24.9	II	240	260	80	82	85	90	100	92	90	90	85	80	110	115	125	135
56	56	1610410	KY	50	M	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	64	162	24.2	II	235	255	82	90	105	90	88	101	95	90	85	80	120	125	150	135
57	57	7717	RK	63	M	LUMBAR CANAL STENOSIS	LAMINECTOMY	WOUND INFILTRATION	1	75	167	26.7	III	235	255	80	85	92	85	80	97	90	85	80	80	110	115	140	130
58	58	1604246	SK	53	M	LUMBAR CANAL STENOSIS	LAMINECTOMY	WOUND INFILTRATION	1	70	167	24.9	III	240	260	85	97	90	85	102	90	91	100	90	82	125	140	135	130
59	59	1609091	KK	62	F	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	60	165	22	II	240	260	82	85	97	90	92	102	90	85	82	80	112	115	140	130
60	60	1543847	SJ	38	M	PIVD	LAMINECTOMY	WOUND INFILTRATION	1	72	167	25.6	II	240	260	85	97	90	91	100	90	80	82	80	80	120	140	135	130

S NO.	SBP_4 HOUR	SBP_8 HOUR	SBP_12 HOUR	SBP_16H OUR	SBP_20 HOUR	SBP_24 HOUR	DBP_0 HOUR	DBP_1 HOUR	DBP_2 HOUR	DBP_3 HOUR	DBP_4 HOUR	DBP_8 HOUR	DBP_12 HOUR	DBP_16 HOUR	DBP_20 HOUR	DBP_24 HOUR	MAP-0 HOUR	MAP-1 HOUR	MAP-2 HOUR	MAP-3 HOUR	MAP-4 HOUR	MAP-8 HOUR	MAP-12 HOUR	MAP-16 HOUR	MAP-20 HOUR	MAP-24 HOUR	SPO2-0 hour(%)	SPO2-1HOUR	SPO2-2HOUR	SPO2-3HOUR	SPO2-4HOUR	SPO2-8HOUR	SPO2-12HOUR	SPO2-16HOUR
1	139	125	115	115	110	110	80	80	80	80	80	80	80	80	80	80	93	100	95	94	99	95	91	91	90	90	98	98	98	98	98	99	98	98
2	135	140	130	122	125	120	80	80	80	95	80	80	90	75	80	80	93	95	105	98	100	108	100	100	97	93	98	98	98	98	98	99	98	98
3	130	125	140	135	130	95	80	80	80	95	80	80	90	75	80	65	93	95	96	112	96	95	107	95	96	73	98	98	98	98	98	99	98	98
4	130	120	120	115	110	110	80	80	80	85	80	85	80	80	80	80	90	91	95	101	96	93	92	91	90	90	98	98	98	98	98	99	98	98
5	135	140	130	120	92	110	80	80	80	80	87	90	80	80	65	80	90	90	91	95	99	100	96	93	74	90	98	98	98	98	98	99	98	98
6	125	130	140	115	115	110	80	80	80	80	80	80	90	80	80	80	93	95	91	93	95	96	102	91	91	90	98	98	98	98	98	99	98	98
7	130	130	145	120	112	110	80	85	80	85	80	80	90	80	85	80	90	91	92	97	96	96	102	93	91	90	98	98	98	98	98	99	98	98
8	135	150	85	120	120	110	80	87	85	90	87	90	60	80	75	80	90	92	95	103	97	108	68	92	92	90	98	98	98	98	98	99	98	98
9	130	120	120	115	110	110	80	85	82	87	85	85	80	85	80	80	90	91	95	103	99	93	93	91	90	90	98	98	98	98	98	99	98	98
10	135	130	120	85	112	110	80	80	85	90	87	80	80	60	82	80	90	91	95	100	99	96	93	68	90	90	98	98	98	98	98	99	98	98
11	140	135	120	115	110	110	80	85	85	82	85	85	85	85	80	80	90	91	91	95	101	99	93	91	90	90	98	98	98	98	98	99	98	98
12	130	120	115	115	110	110	80	80	85	85	85	85	80	80	80	80	90	91	99	100	97	93	91	91	90	90	98	98	98	98	98	99	98	98
13	135	141	130	120	115	110	80	82	80	82	85	86	81	84	80	80	90	91	95	97	99	101	97	93	91	90	98	98	98	98	98	99	98	98
14	130	135	140	130	115	110	80	83	80	85	80	75	82	80	80	80	93	96	95	100	96	98	99	96	92	90	98	98	98	98	98	99	98	98
15	140	131	125	120	82	110	80	80	82	80	85	82	70	80	62	80	91	91	95	97	101	97	88	93	69	90	98	98	98	98	98	99	98	98
16	130	135	142	120	115	110	80	85	85	85	90	75	80	85	80	80	91	96	100	105	103	95	100	97	91	90	98	98	98	98	98	99	98	98
17	140	150	130	125	115	110	80	80	85	80	80	90	80	80	80	80	91	93	95	98	100	110	97	95	92	90	98	98	98	98	98	99	98	98
18	140	135	130	130	120	110	80	85	80	90	85	85	80	80	80	80	94	102	100	112	103	102	94	94	93	90	98	98	98	98	98	99	98	98
19	149	140	130	120	110	110	80	80	80	75	80	90	85	80	80	80	93	97	100	98	103	107	100	93	90	90	98	98	98	98	98	99	98	98
20	142	146	135	130	120	120	80	80	85	90	80	80	75	80	80	80	95	97	102	107	101	102	95	97	93	93	98	98	98	98	98	99	98	98
21	150	145	140	130	120	110	80	85	92	60	75	85	80	80	80	80	93	100	110	87	100	105	100	97	93	90	98	98	98	98	98	99	98	98
22	144	150	135	130	125	120	80	80	90	80	84	95	85	80	80	80	93	97	107	102	104	113	102	97	95	93	98	98	98	98	98	99	98	98
23	139	152	135	130	120	115	80	80	90	85	80	86	81	80	80	80	94	98	108	102	100	108	99	97	93	92	98	98	98	98	98	99	98	98
24	135	148	131	128	125	120	80	80	90	82	85	96	90	70	70	80	93	95	103	102	102	113	104	89	88	93	98	98	98	98	98	99	98	98
25	130	132	145	130	135	120	80	80	85	90	80	80	90	80	85	80	93	97	102	109	97	97	108	97	102	93	98	98	98	98	98	99	98	98
26	135	150	130	120	110	110	80	85	90	80	85	70	80	80	80	80	95	100	110	97	102	97	97	93	90	90	98	98	98	98	98	99	98	98
27	142	150	130	125	120	120	80	80	85	80	80	80	80	80	80	80	95	97	102	100	101	103	97	95	93	93	98	98	98	98	98	99	98	98
28	130	130	125	120	115	110	80	80	85	90	80	76	80	80	80	80	93	97	102	108	97	94	95	93	92	90	98	98	98	98	98	99	98	98
29	135	130	125	120	110	110	80	85	60	85	86	80	80	80	80	80	97	102	100	105	102	97	95	93	90	90	98	98	98	98	98	99	98	98
30	141	145	140	135	130	120	80	85	60	80	82	96	80	80	80	80	97	102	90	100	102	112	100	98	97	93	98	98	98	98	98	99	98	98
31	130	125	120	115	110	110	75	82	70	85	82	79	80	75	70	70	88	95	86	103	98	94	93	88	83	83	98	98	98	98	98	99	98	98
32	125	120	139	130	125	122	70	70	80	85	80	80	86	80	75	70	86	83	87	100	93	93	102	98	96	95	98	98	98	98	98	99	98	98
33	149	135	130	125	122	120	70	70	70	80	85	85	80	75	70	70	83	83	83	93	103	101	100	95	93	91	98	98	98	98	98	99	98	98
34	130	125	119	115	110	110	75	82	70	85	82	79	80	75	70	70	88	95	86	103	98	94	93	88	83	83	98	98	98	98	98	99	98	98
35	120	140	130	125	122	111	71	70	70	70	80	85	80	75	70	71	83	83	82	84	93	103	100	95	93	91	98	98	98	98	98	99	98	98
36	130	125	120	115	112	110	70	75	90	85	80	80	80	70	70	70	83	96	103	99	98	96	93	88	84	83	98	98	98	98	98	99	98	98
37	130	135	130	125	120	115	70	75	75	80	80	85	80	70	70	70	83	95	93	104	98	101	98	96	92	88	98	98	98	98	98	99	98	98
38	122	115	110	111	112	110	80	85	80	75	70	70	70	71	70	70	93	103	100	95	93	84	82	83	83	82	98	98	98	98	98	99	98	98
39	122	139	125	120	115	110	75	82	85	80	82	85	79	80	75	70	88	95	103	98	95	102	94	93	88	83	98	98	98	98	98	99	98	98
40	130	125	119	115	110	110	75	82	70	85	82	79	80	75	70	70	88	98	92	103	98	94	93	88	83	83	98	98	98	98	98	99	98	98
41	147	140	135	130	120	120	80	80	80	85	90	80	80	80	80	80	97	98	99	103	109	100	98	97	93	93	98	98	98	98	98	99	98	98
42	140	145	135	130	120	120	80	80	80	85	80	90	80	80	80	80	93	97	97	102	100	108	98	97	93	93	98	98	98	98	98	99	98	98
43	145	149	142	140	135	130	75	80	85	90	80	90	80	80	80	80	92	97	102	107	102	110	101	1OO	98	97	98	98	98	98	98	99	98	98
44	122	122	120	115	115	110	80	80	80	80	80	80	80	80	80	80	94	97	100	97	94	93	92	92	90	90	98	98	98	98	98	99	98	98
45	140	130	142	135	130	120	80	85	90	80	80	80	85	85	80	80	97	102	107	103	100	97	104	102	97	93	98	98	98	98	98	99	98	98
46	140	135	130	130	120	120	80	85	70	90	60	85	70	80	80	80	97	102	93	109	87	102	90	97	93	93	98	98	98	98	98	99	98	98
47	130	137	147	120	115	120	80	85	85	85	80	80	90	80	80	80	93	98	102	103	97	99	109	93	92	93	98	98	98	98	98	99	98	98
48	145	152	145	140	130	120	80	85	80	70	80	70	60	70	80	80	97	102	100	97	102	97	88	93	97	93	98	98	98	98	98	99	98	98
49	138	142	130	120	120	110	80	80	85	100	70	90	80	80	80	80	90	93	102	113	93	107	97	93	93	90	98	98	98	98	98	99	98	98
50	131	130	120	115	110	120	80	80	80	90	80	80	80	80	80	80	93	97	98	109	97	97	93	92	90	93	98	98	98	98	98	99	98	98
51	150	135	130	120	115	120	80	85	80	80	85	80	85	80	80	80	93	100	98	100	107	98	100	93	92	93	98	98	98	98	98	99	98	98
52	135	130	152	130	120	110	80	85	80	90	85	80	90	80	80	80	93	100	98	108	102	97	111	97	93	90	98	98	98	98	98	99	98	98
53	140	150	142	146	130	125	80	80	80	85	80	90	86	92	80	80	95	97	102	102	100	110	105	110	97	95	98	98	98	98	98	99	98	98
54	130	125	120	110	110	110	80	85	90	80	80	85	80	80	80	80	93	98	109	98	97	98	93	90	90	90	98	98	98	98	98	99	98	98
55	145	135	125	120	110	110	80	85	85	80	90	80	80	80	80	80	90	95	98	98	109	98	96	93	90	90	98	98	98	98	98	99	98	98
56	130	145	130	120	110	110	80	85	80	80	80	80	80	80	80	80	93	98	103	98	97	102	97	93	90	90	98	98	98	98	98	99	98	98
57	130	145	130	130	120	110	80	80	80	80	80	90	70	75	80	80	90	92	100	97	97	108	90	93	93	90	98	98	98	98	98	99	98	98
58	150	135	130	145	130	120	80	90	80	80	75	85	80	90	80	80	95	107	98	97	100	102	97	108	97	93	98	98	98	98	98	99	98	98
59	132	145	140	130	120	110	80	80	80	80	82	90	80	80	80	80	91	92	100	97	99	108	100	97	93	90	98	98	98	98	98	99	98	98
60	150	135	130	120	120	120	80	90	80	80	70	80	80	88	80	80	93	107	98	97	97	98	97	93	93	93	98	98	98	98	98	99	98	98

S NO.	SPO2-20HOUR	SPO2-24HOUR	RR 0HOUR	RR1HOUR	RR 2HOUR	RR 3HOUR	RR 4HOUR	RR 6HOUR	RR 8HOUR	RR 12HOUR	RR 16HOUR	RR 20HOUR	RR 24HOUR	NRS SCORE_ FOR SURGICAL SITE PAIN	NRS SCORE AFTER SHIFTING TO PACU TIME 0HR	NRS SCORE_ 1 HOUR	NRS SCORE_ 2 HOUR	NRS SCORE_ 3 HOUR	NRS SCORE_ 4 HOUR	NRS SCORE_ 8 HOUR	NRS SCORE_ 12 HOUR	NRS SCORE_ 16 HOUR	NRS SCORE_ 20 HOUR	NRS SCORE_ 24HOUR	RESCUE ANALGESIC _TIME 0	RESCUE ANALGESIC _1 HOUR
1	97	98	17	18	17	18	17	17	17	17	18	18	17		3	5	3	3	5	3	2	1	1	1	0	5
2	97	98	17	18	17	18	17	17	17	17	18	18	17		3	3	5	2	3	5	2	1	1	1	0	0
3	97	98	17	18	17	18	17	17	17	17	18	18	17		2	3	3	5	3	2	6	3	2	1	0	0
4	97	98	17	18	17	18	17	17	17	17	18	18	17		1	2	3	5	3	2	1	0	0	0	0	0
5	97	98	17	18	17	18	17	17	17	17	18	18	17		0	1	2	3	3	5	3	2	1	0	0	0
6	97	98	17	18	17	18	17	17	17	17	18	18	17		0	0	1	2	3	3	5	3	2	1	0	0
7	97	98	17	18	17	18	17	17	17	17	18	18	17		0	1	3	5	3	3	5	3	2	1	0	0
8	97	98	17	18	17	18	17	17	17	17	18	18	17		0	2	3	5	3	6	3	2	1	0	0	0
9	97	98	17	18	17	18	17	17	17	17	18	18	17		0	0	3	5	3	2	1	0	0	0	0	0
10	97	98	17	18	17	18	17	17	17	17	18	18	17		0	2	3	5	3	3	2	1	0	0	0	0
11	97	98	17	18	17	18	17	17	17	17	18	18	17		0	1	2	3	5	3	3	2	1	0	0	0
12	97	98	'17	18	17	18	17	17	17	17	18	18	17		0	2	3	4	3	2	2	1	0	0	0	0
13	97	98	17	18	17	18	17	17	17	17	18	18	17		0	2	2	3	3	5	3	3	2	1	0	0
14	97	98	17	18	17	18	17	17	17	17	18	18	17		0	2	3	4	3	3	5	3	2	1	0	0
15	97	98	17	18	17	18	17	17	17	17	18	18	17		0	2	3	3	5	3	2	2	1	0	0	0
16	97	98	17	18	17	18	17	17	17	17	18	18	17		0	2	3	4	3	3	6	3	2	1	0	0
17	97	98	17	18	17	18	17	17	17	17	18	18	17		0	1	2	3	3	5	2	2	1	0	0	0
18	97	98	17	18	17	18	17	17	17	17	18	18	17		2	3	3	5	3	3	2	1	0	0	0	0
19	97	98	17	18	17	18	17	17	17	17	18	18	17		0	1	2	3	4	3	3	2	1	1	0	0
20	97	98	17	18	17	18	17	17	17	17	18	18	17		2	2	3	3	3	5	3	2	1	0	0	0
21	97	98	17	18	17	18	17	17	17	17	18	18	17		2	2	4	3	5	3	2	1	0	0	0	0
22	97	98	17	18	17	18	17	17	17	17	18	18	17		0	1	2	2	3	5	3	2	1	1	0	0
23	97	98	17	18	17	18	17	17	17	17	18	18	17		0	3	5	2	3	4	3	2	1	1	0	0
24	97	98	17	18	17	18	17	17	17	17	18	18	17		0	3	3	4	3	5	2	2	1	0	0	0
25	97	98	17	18	17	18	17	17	17	17	18	18	17		2	2	3	5	3	3	4	3	2	1	0	0
26	97	98	17	18	17	18	17	17	17	17	18	18	17		3	3	4	3	3	5	3	3	2	1	0	0
27	97	98	17	18	17	18	17	17	17	17	18	18	17		2	2	3	3	3	5	3	2	1	0	0	0
28	97	98	17	18	17	18	17	17	17	17	18	18	17		2	3	3	5	3	2	1	0	0	0	0	0
29	97	98	17	18	17	18	17	17	17	17	18	18	17		2	3	3	5	3	3	2	1	0	0	0	0
30	97	98	17	18	17	18	17	17	17	17	18	18	17		2	3	5	3	3	4	3	2	1	0	0	0
31	97	98	17	18	17	18	17	17	17	17	18	18	17		3	4	3	5	3	2	1	1	0	0	0	5
32	97	98	17	18	17	18	17	17	17	17	18	18	17		2	2	3	5	3	2	5	3	2	1	0	0
33	97	98	17	18	17	18	17	17	17	17	18	18	17		2	1	1	3	5	3	2	1	1	1	0	0
34	97	98	17	18	17	18	17	17	17	17	18	18	17		3	4	3	5	3	2	1	1	0	0	0	5
35	97	98	17	18	17	18	17	17	17	17	18	18	17		1	1	1	3	3	5	3	2	1	1	0	0
36	97	98	17	18	17	18	17	17	17	17	18	18	17		2	3	5	3	2	1	1	1	1	1	0	0
37	97	98	17	18	17	18	17	17	17	17	18	18	17		3	4	2	5	3	2	1	1	1	1	0	5
38	97	98	17	18	17	18	17	17	17	17	18	18	17		3	5	3	2	1	1	0	0	0	0	0	5
39	97	98	17	18	17	18	17	17	17	17	18	18	17		2	3	5	3	2	4	3	2	1	0	0	0
40	97	98	17	18	17	18	17	17	17	17	18	18	17		3	4	3	5	3	2	1	1	0	0	0	5
41	97	98	17	18	17	18	17	17	17	17	18	18	17		2	2	3	3	5	3	2	1	0	0	0	0
42	97	98	17	18	17	18	17	17	17	17	18	18	17		0	0	2	3	3	4	3	2	1	0	0	0
43	97	98	17	18	17	18	17	17	17	17	18	18	17		0	0	2	3	3	5	3	2	1	1	0	0
44	97	98	17	18	17	18	17	17	17	17	18	18	17		3	3	4	3	2	2	1	0	0	0	0	0
45	97	98	17	18	17	18	17	17	17	17	18	18	17		2	3	3	5	3	3	4	3	2	1	0	0
46	97	98	17	18	17	18	17	17	17	17	18	18	17		2	3	3	4	3	3	2	1	0	0	0	0
47	97	98	17	18	17	18	17	17	17	17	18	18	17		2	3	3	4	3	3	5	3	2	1	0	0
48	97	98	17	18	17	18	17	17	17	17	18	18	17		2	2	3	4	3	5	3	2	1	0	0	0
49	97	98	17	18	17	18	17	17	17	17	18	18	17		0	2	3	4	3	5	3	2	1	0	0	0
50	97	98	17	18	17	18	17	17	17	17	18	18	17		2	2	3	4	2	2	1	1	0	0	0	0
51	97	98	17	18	17	18	17	17	17	17	18	18	17		2	2	3	3	5	3	2	1	0	0	0	0
52	97	98	17	18	17	18	17	17	17	17	18	18	17		2	2	3	4	3	3	6	3	2	1	0	0
53	97	98	17	18	17	18	17	17	17	17	18	18	17		2	3	4	3	3	5	3	4	2	2	0	0
54	97	98	17	18	17	18	17	17	17	17	18	18	17		3	3	5	3	2	1	0	0	0	0	0	0
55	97	98	17	18	17	18	17	17	17	17	18	18	17		2	2	3	3	5	3	2	1	0	0	0	0
56	97	98	17	18	17	18	17	17	17	17	18	18	17		3	3	5	3	2	4	3	2	1	0	0	0
57	97	98	17	18	17	18	17	17	17	17	18	18	17		2	3	4	3	2	5	3	2	1	0	0	0
58	97	98	17	18	17	18	17	17	17	17	18	18	17		3	4	3	3	5	3	3	5	2	1	0	5
59	97	98	17	18	17	18	17	17	17	17	18	18	17		3	3	4	3	3	5	3	2	1	0	0	0
60	97	98	17	18	17	18	17	17	17	17	18	18	17		3	4	3	3	5	3	2	2	1	1	0	5

S NO.	RESCUE ANALGESIC _2 HOUR	RESCUE ANALGESIC _3 HOUR	RESCUE ANALGESIC _4 HOUR	RESCUE ANALGESIC _8 HOUR	RESCUE ANALGESIC _12 HOUR	RESCUE ANALGESIC _16 HOUR	RESCUE ANALGESIC _20 HOUR	RESCUE ANALGESIC _24HOUR	No. of time RESCUE ANALGESIC ADMINISTERED	MODIFIED BROMAGE SCORE	MBS_TIME 0HR	MBS_1 HOUR	MBS_2 HOUR	MBS_3 HOUR	MBS_4 HOUR	MBS_8 HOUR	MBS_12 HOUR	MBS_16 HOUR	MBS_20 HOUR	MBS_24 HOUR	ADVERSE EVENTS	NO OF EPISODES	TREATMENT ADMINISTERED OR NOT	MORPHINE CONSUMPTION IN 24 HR(MG)	WOUND HEMATOMA/ INFECTION
1	0	0	5	0	0	0	0	0	2		1	0	0	0	0	0	0	0	0	0	NA	NA	NO	10	NO
2	5	0	0	5	0	0	0	0	2		1	0	0	0	0	0	0	0	0	0	NA	NA	NO	10	NO
3	0	5	0	0	5	0	0	0	2		1	0	0	0	0	0	0	0	0	0	HYPOTENSION	1	YES	10	NO
4	0	5	0	0	0	0	0	0	1		1	0	0	0	0	0	0	0	0	0	NA	NA	NO	5	NO
5	0	0	0	5	0	0	0	0	1		0	0	0	0	0	0	0	0	0	0	HYPOTENSION	1	YES	5	NO
6	0	0	0	0	5	0	0	0	1		0	0	0	0	0	0	0	0	0	0	NAUSEA,VOMITING	1	YES	5	NO
7	0	5	0	0	5	0	0	0	2		0	0	0	0	0	0	0	0	0	0	NA	NA	NO	10	NO
8	0	5	0	5	0	0	0	0	2		0	0	0	0	0	0	0	0	0	0	HYPOTENSION	1	YES	10	NO
9	0	5	0	0	0	0	0	0	1		0	0	0	0	0	0	0	0	0	0	PRURITIS	1	YES	5	NO
10	0	5	0	0	0	0	0	0	1		0	0	0	0	0	0	0	0	0	0	HYPOTENSION	1	YES	5	NO
11	0	0	5	0	0	0	0	0	1		1	0	0	0	0	0	0	0	0	0	NA	NA	NO	5	NO
12	0	5	0	0	0	0	0	0	1		1	0	0	0	0	0	0	0	0	0	NA	NA	NO	5	NO
13	0	0	0	5	0	0	0	0	1		1	0	0	0	0	0	0	0	0	0	NAUSEA,VOMITING	1	YES	5	NO
14	0	5	0	0	5	0	0	0	2		1	0	0	0	0	0	0	0	0	0	PRURITIS	1	YES	10	NO
15	0	0	5	0	0	0	0	0	1		1	0	0	0	0	0	0	0	0	0	HYPOTENSION	1	YES	5	NO
16	0	5	0	0	5	0	0	0	2		1	0	0	0	0	0	0	0	0	0	NA	NA	NO	10	NO
17	0	0	0	5	0	0	0	0	1		1	0	0	0	0	0	0	0	0	0	NA	NA	NO	5	NO
18	0	5	0	0	0	0	0	0	1		1	1	0	0	0	0	0	0	0	0	NA	NA	NO	5	NO
19	0	0	5	0	0	0	0	0	1		1	1	0	0	0	0	0	0	0	0	NA	NA	NO	5	NO
20	0	0	0	5	0	0	0	0	1		1	1	0	0	0	0	0	0	0	0	NA	NA	NO	5	NO
21	5	0	5	0	0	0	0	0	2		1	1	0	0	0	0	0	0	0	0	NAUSEA,VOMITING	1	YES	10	NO
22	0	0	0	5	0	0	0	0	1		1	0	0	0	0	0	0	0	0	0	NA	NA	NO	5	NO
23	5	0	0	5	0	0	0	0	2		1	0	0	0	0	0	0	0	0	0	NA	NA	NO	10	NO
24	0	5	0	5	0	0	0	0	2		1	0	0	0	0	0	0	0	0	0	NAUSEA,VOMITING	1	YES	10	NO
25	0	5	0	0	5	0	0	0	2		1	1	0	0	0	0	0	0	0	0	NA	NA	NO	10	NO
26	5	0	0	5	0	0	0	0	2		1	1	0	0	0	0	0	0	0	0	NAUSEA,VOMITING	1	YES	10	NO
27	0	0	0	5	0	0	0	0	1		1	1	0	0	0	0	0	0	0	0	NA	NA	NO	5	NO
28	0	5	0	0	0	0	0	0	1		1	1	0	0	0	0	0	0	0	0	NA	NA	NO	5	NO
29	0	5	0	0	0	0	0	0	1		1	1	0	0	0	0	0	0	0	0	NA	NA	NO	5	NO
30	5	0	0	5	0	0	0	0	2		1	1	0	0	0	0	0	0	0	0	NAUSEA,VOMITING	1	YES	10	NO
31	0	5	0	0	0	0	0	0	2		1	0	0	0	0	0	0	0	0	0	NA	NA	NO	10	NO
32	0	5	0	0	5	0	0	0	2		1	0	0	0	0	0	0	0	0	0	NAUSEA,VOMITING	1	YES	10	NO
33	0	0	5	0	0	0	0	0	1		0	0	0	0	0	0	0	0	0	0	NA	NA	NO	5	NO
34	0	5	0	0	0	0	0	0	2		1	0	0	0	0	0	0	0	0	0	NA	NA	NO	10	NO
35	0	0	0	5	0	0	0	0	1		0	0	0	0	0	0	0	0	0	0	NAUSEA,VOMITING	1	YES	5	NO
36	5	0	0	0	0	0	0	0	1		0	0	0	0	0	0	0	0	0	0	NA	NA	NO	5	NO
37	0	5	0	0	0	0	0	0	2		1	0	0	0	0	0	0	0	0	0	NAUSEA,VOMITING	1	YES	10	NO
38	0	0	0	0	0	0	0	0	1		1	0	0	0	0	0	0	0	0	0	NA	NA	NO	5	NO
39	5	0	0	5	0	0	0	0	2		1	0	0	0	0	0	0	0	0	0	NA	NA	NO	10	NO
40	0	5	0	0	0	0	0	0	2		1	0	0	0	0	0	0	0	0	0	NA	NA	NO	10	NO
41	0	0	5	0	0	0	0	0	1		1	1	0	0	0	0	0	0	0	0	NA	NA	NO	5	NO
42	0	0	0	5	0	0	0	0	1		1	0	0	0	0	0	0	0	0	0	NAUSEA,VOMITING	1	YES	5	NO
43	0	0	0	5	0	0	0	0	1		1	0	0	0	0	0	0	0	0	0	NA	NA	NO	5	NO
44	5	0	0	0	0	0	0	0	1		1	1	0	0	0	0	0	0	0	0	NA	NA	NO	5	NO
45	0	5	0	0	5	0	0	0	2		1	1	0	0	0	0	0	0	0	0	PRURITIS	1	YES	10	NO
46	0	5	0	0	0	0	0	0	1		1	1	0	0	0	0	0	0	0	0	NA	NA	NO	5	NO
47	0	5	0	0	5	0	0	0	2		1	1	0	0	0	0	0	0	0	0	NAUSEA,VOMITING	1	YES	10	NO
48	0	5	0	5	0	0	0	0	2		1	1	0	0	0	0	0	0	0	0	NA	NA	NO	10	NO
49	0	5	0	5	0	0	0	0	2		1	1	0	0	0	0	0	0	0	0	NA	NA	NO	10	NO
50	0	5	0	0	0	0	0	0	1		1	0	0	0	0	0	0	0	0	0	NA	NA	NO	5	NO
51	0	0	5	0	0	0	0	0	1		1	0	0	0	0	0	0	0	0	0	NAUSEA,VOMITING	1	YES	5	NO
52	0	5	0	0	5	0	0	0	2		1	0	0	0	0	0	0	0	0	0	NA	NA	NO	10	NO
53	5	0	0	5	0	5	0	0	3		1	0	0	0	0	0	0	0	0	0	NAUSEA,VOMITING	1	YES	15	NO
54	5	0	0	0	0	0	0	0	1		1	1	0	0	0	0	0	0	0	0	NA	NA	NO	5	NO
55	0	0	5	0	0	0	0	0	1		1	1	0	0	0	0	0	0	0	0	NA	NA	NO	5	NO
56	5	0	0	5	0	0	0	0	2		1	1	0	0	0	0	0	0	0	0	PRURITIS	1	YES	10	NO
57	5	0	0	5	0	0	0	0	2		1	1	0	0	0	0	0	0	0	0	NA	NA	NO	10	NO
58	0	0	5	0	0	5	0	0	3		1	1	0	0	0	0	0	0	0	0	NAUSEA,VOMITING	1	YES	15	NO
59	5	0	0	5	0	0	0	0	2		1	1	0	0	0	0	0	0	0	0	NA	NA	NO	10	NO
60	0	0	5	0	0	0	0	0	2		1	1	0	0	0	0	0	0	0	0	NAUSEA,VOMITING	1	YES	10	NO

Baba Farid University
of Health Sciences
Sadiq Road
Faridkot-151 203 (Pb). INDIA.
Phone : 01639-256232,256236
Tele/Fax : 01639-256235
Email – Thesisbfuhs@gmail.com

(12)

No. BFUHS/2K23p-TH/ 13217 **Date** 29/12/23

The Principal
Dayanand Medical College & Hospital
Ludhiana

Subject:: Approval of Plan of Thesis.

This is to inform you that the Faculty of Medical Sciences in its meeting held on 25.09.2023 has approved the plan of thesis of **Sarvesh Kumar**, a student of your college for **MD Anaesthesiology** along with the names of Supervisor/Co-Supervisor as under:-

Topic Plan of Thesis
Comparative evaluation of surgical site wound infiltration versus epidural instillation of 0.2% ropivacaine following lumbar laminectomy .

Supervisor	**Co-Supervisor:-**	**Co-Supervisor:-**
Dr. Sandeep Kundra	Dr. Gurpreeti Kaur	Dr. Ashwani Kumar Chaudhary
Professor	Assoc. Professor	Prof. & Head
Dept. of Anaesthesiology	Dept. of Anaesthesiology	Dept. of Neuro-Surgery

The student may submit the thesis in triplicate alongwith the plan in triplicate also, to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She may be directed to attach a photocopy of this letter with the forwarding letter while submitting thesis in the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic, if any.

23/12/2023
Controller of Examinations

Note :

1. *If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.*

COMPARATIVE EVALUATION OF SURGICAL SITE WOUND INFILTRATION VERSUS EPIDURAL INSTILLATION OF 0.2% ROPIVACAINE FOLLOWING LUMBAR LAMINECTOMY

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED IN

PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

MD

In

ANESTHESIOLOGY

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES

FARIDKOT

DR. SARVESH KUMAR

AUGUST, 2022

DEPARTMENT OF ANESTHESIOLOGY
DAYANAND MEDICAL COLLEGE AND HOSPITAL
LUDHIANA

ABSTRACT OF PLAN OF THESIS

Title	COMPARATIVE EVALUATION OF SURGICAL SITE WOUND INFILTRATION VERSUS EPIDURAL INSTILLATION OF 0.2% ROPIVACAINE FOLLOWING LUMBAR LAMINECTOMY
For the degree of	MD Anesthesia
Name of the candidate	Dr. Sarvesh Kumar
Supervisor	Dr Sandeep Kundra, Professor, Department of Anesthesiology, DMCH, Ludhiana
Co-Supervisor	Dr Gurpreeti Kaur, Associate Professor, Department of Anesthesiology, DMCH, Ludhiana Dr Ashwani Kumar Chaudhary, Prof and Head, Department of Neurosurgery, DMCH, Ludhiana
Institution	Dayanand Medical College and Hospital,Ludhiana
University	Baba Farid University of Health Sciences, Faridkot

Introduction: Surgical site wound infiltration using local anesthetic agent is a widely used and effective technique for prophylaxis of post operative pain. However, pain relief using this technique is for a limited duration. Epidural analgesia is again a widely used and effective technique for a variety of surgeries. However, epidural analgesia requires placement of catheter in the epidural space and this can be challenging in spine surgeries. In Lumbar Laminectomy surgeries, epidural space is easily accessible. Hence, local anasethetic infiltration can be directly applied on the epidural space. This inexpensive and easy to use technique can provide effective postoperative analgesia.

Aim of Study: To compare the efficacy of epidural infiltration of 10ml of 0.2% ropivacaine with sub-cutaneous wound infiltration of 10ml 0.2% ropivacaine for post operative pain relief following lumbar laminectomy.

Materials & methods: 60 adult patients aged 18-65 belonging to ASA I, II and III scheduled for lumbar laminectomy under general anesthesia will be randomly allocated to two groups of 30 patients each using a computer-generated table of random numbers. Group A patients will be administered sub-cutaneous wound infiltration of 10ml 0.2% ropivacaine. Group B patients will be administered epidural instillation of 10ml 0.2% ropivacaine. Post operatively, patients will be shifted to the PACU, where monitoring of HR, NIBP, RR and SpO2 and recording of NRS would be done every hourly for first initial 4 hours and after that every 4 hourly till the initial 24 hours. Any patient complaining of pain or NRS >4, will be administered Inj morphine 5mg. Duration of analgesia and total morphine consumption in 24 hours will be recorded.

Clinical Significance: This study will help to assess the safety and efficacy of direct epidural instillation of local anesthetic solution for management of pain following lumbar laminectomy.

Keywords: Ropivacaine, wound infiltration, epidural instillation, Post operative pain

(Signature) Candidate

(Signature) Co-supervisor

(Signature) Co-supervisor

(Signature) Supervisor

(Signature) Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis titled **"COMPARATIVE EVALUATION OF SURGICAL SITE WOUND INFILTRATION VERSUS EPIDURAL INSTILLATION OF 0.2% ROPIVACAINE FOLLOWING LUMBAR LAMINECTOMY"** exist in the Department of Anesthesia at Dayanand Medical College and Hospital, Ludhiana and will be provided to the candidate. We will see that the data being included in the thesis are genuine and is collected by the candidate himself under our supervision and guidance.

Supervisor

Dr Sandeep Kundra
Professor
Department of Anesthesiology
DMCH, Ludhiana

Co-Supervisor

Dr Gurpreeti Kaur
Associate Professor
Department of Anesthesiology
DMCH, Ludhiana

Dr Ashwani Kumar Chaudhary
Professor & Head
Department of Neurosurgery
DMCH, Ludhiana

Head of the Department

Dr. Anju Grewal
Professor & Head
Department of Anesthesia
DMCH, Ludhiana

Place : _____

Date : _____

APPROVAL PROFORMA
BY
RESEARCH & ETHICAL COMMITTEE
DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA

Name of candidate	Dr. Sarvesh Kumar
Department	Anesthesiology
Topic of Thesis	Comparative evaluation of surgical site wound infiltration versus epidural instillation of 0.2% Ropivacaine following lumbar laminectomy
Likely date of appearing in PG examination	May/June, 2024
Date of enrollment	23rd March, 2022
Name of Head of Department	Dr. Anju Grewal
1) Supervisor **2) Co-Supervisor**	Dr. Sandeep Kundra Dr. Gurpreeti Kaur Dr. Ashwani Kumar Chaudhary
Signature of Members of Research Committee with Stamp	**Signature of Members of Ethics Committee with Stamp**
Dr. Harpreet Kaur (Professor & Head, Pathology)	Mr. R K Sharma (Legal Expert)
Dr. Jaspal Singh (Professor & Head, Surgery)	Dr. RamitMahajan (Associate Professor, Gastroenterology)
Dr. Dinesh Gupta (Professor & Head, Medicine)	Dr. Anu Sharma (Professor, Anatomy)
Dr. Sandeep Kaushal (Dean Academics & Professor & Head, Pharmacology)	Dr. Sandeep Kaushal (Dean Academics & Professor & Head, Pharmacology)
Dr. Gurpreet S Wander (Vice Principal)	Dr. Gurpreet S Wander (Vice Principal & Professor & Head, Cardiology)
	Dr. Gagandeep Singh (Secretary, Ethics Committee Professor & Head, Neurology)

Approved: Yes / No

Dr. Sandeep Puri
Chairperson
Research Committee

Chairperson
Research Committee

Approved: Yes / No

Prof. Arvind Malhotra
Chairperson
Ethics Committee

Chairperson
Ethics Committee

BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT

PROFORMA FOR REGISTRATION OF SUBJECT FOR DISSERTATION

1.	NAME OF THE CANDIDATE AND ADDRESS	Dr Sarvesh kumar House number 211, Ward no 7, Dasuya, Distt Hoshiarpur
2.	NAME OF THE INSTITUTE	DAYANAND MEDICAL COLLEGE AND HOSPITAL LUDHIANA
3.	COURSE OF STUDY AND SUBJECT	MD ANESTHESIOLOGY
4.	DATE OF ADMISSION OF COURSE	23/03/22
5.	TITLE OF THE TOPIC	COMPARATIVE EVALUATION OF SURGICAL SITE WOUND INFILTRATION VERSUS EPIDURAL INSTILLATION OF 0.2% ROPIVACAINE FOLLOWING LUMBAR LAMINECTOMY

6. BRIEF RESUME OF THE INTENDED WORK

6.1 NEED FOR THE STUDY

Pain after surgery is one of the chief concerns for patients scheduled for surgery. Infact, moderate to severe pain is reported to occur in 30-80% of post surgical patients on the first postoperative day.[1] Untreated pain can have various undesirable consequences like increased heart rate and blood pressure due to sympathetic stimulation. There is increased release of catecholamines, predisposing patients to adverse cardiac events. Inadequate treatment of pain contributes to patient dissatisfaction and may lead to central sensitization and chronic postsurgical pain.[2]

Lumbar Laminectomy and interlaminar decompression are commonly performed procedures on the spine. The goal of these procedures is to alleviate symptoms, such as pain, numbness and weakness of legs and buttocks, caused by compression of the caudaequina due to narrowing of the spinal canal in the degenerating spine.[3] With an increase in the aging population, the incidence of degenerative spine diseases and hence number of such surgeries are increasing.[4] However, pain following lumbar laminectomy remains a significant challenge, with many patients complaining of excruciating pain following surgery.

Often, patients are managed using a combination of parentral opioids and NSAIDs, with opioids continuing to remain the mainstay of analgesic regimens. While opioids reduce nociceptive somatic, visceral, and neuropathic pain, they may also lead to undesirable effects such as respiratory depression, urinary retention, nausea and vomiting, constipation, itching, opioid-induced hyperalgesia, tolerance, addiction, and immune system disorders.[3] Consumption of opioids can prolong the length of hospital stay as well, thus having cost implications.[5]

Thus, various loco-regional techniques have been attempted to reduce peri-operative use of opioids. These techniques include sub-cutaneous wound site infiltration using local anesthetic agents, epidural administration of analgesics, steroids and local anesthetic agents. Surgical site wound infiltration using local anesthetic is a popular and effective technique following abdominal surgeries and it has been reported to reduce post-operative pain and analgesic requirements following spine surgery as well. Sub-cutaneous wound infiltration using ropivacaine at the end of surgery is routinely practiced at our institution. The disadvantage of single sub-cutaneous injection of local anesthetic is that it is has a limited duration of action. To overcome this, some researchers have attempted continuous wound irrigation of local anesthetics through catheters placed into the surgical wound.[6] However, continuous wound irrigation is associated with concerns about catheter displacement, infection risk, cost and chances of systemic local anesthetic toxicity.[7]

During lumbar laminectomy, the epidural space is visible and thus easily accessible. This situation allows surgeons to apply an epidural bolus of local analgesics, potentially providing a safe and effective method for pain relief. In fact, epidural administration of multiple analgesics like opioids and steroids has been employed successfully.[8] Epidural administration of local anesthetics using catheters placed in epidural space is a commonly employed technique for pain relief following a variety of surgeries including spine surgeries. However, placement of epidural catheter at the site of surgery can interfere with surgical exposure and there is concern of infection as well. To overcome this, Samagh et al administered a single caudal epidural injection of local anesthetic and found it to be effective.[9]

Therefore, we hypothesized that single epidural infiltration of local anesthetic at the end of surgery before closure of surgical wound can provide analgesia after spine surgery. Despite a thorough search of literature, we could not find any study wherein direct epidural application of local anesthetics had been evaluated for pain relief. Thus, the present

study was conceived to compare the efficacy of epidural infiltration of ropivacaine with sub-cutaneous wound infiltration for prophylaxis of pain following lumbar laminectomy.[10,11] We chose ropivacaine 0.2 % as the local anesthetic agent because it produces sensory blockade leaving motor function largely unaffected. It has a longer duration of action as compared to lignocaine, has vaso-constrictive properties, causes selective sensory blockade and is less cardiotoxicity as compared to bupivacaine.[11]

6.2 REVIEW OF LITERATURE

Various drugs and techniques have been employed for the management of pain following lumbar laminectomy. Nonsteroidal anti-inflammatory drugs and opioids have been the mainstay of post operative pain management, but these are associated with various adverse effects. The concept of multi-modal analgesia involves use of different analgesic agents/regional analgesic techniques, in an effort to reduce adverse effects due to individual drugs.[12] Incision site wound infiltration with local anesthetic has been successfully used as part of multi-modal approach for pain relief. Wound infusion with local anesthetic continuously infiltrates the peripheral nerve endings, and attenuates pain by directly blocking the neuronal membrane sodium channels.

Xu B et al conducted study in 2015 to observe the analgesic efficacy of ropivacaine for postoperative pain following thoracolumbar spinal surgery. In one of the groups, patients received 0.33% ropivacaine by pump through the wound, whereas the other group received IV multimodal analgesia. The authors reported no significant differences in the pain level between the two groups. The results, therefore, suggest that local infusion of ropivacaine achieved similar analgesic effects to intravenous delivery of analgesic drugs.[13]

Adesope O et al, conducted a meta-analysis in 2016 to assess the efficacy of local anesthetic wound infiltration in reducing pain scores and opioid consumption in women undergoing caesarean delivery. Total number of studies included in the final analysis were twenty one (11 studies using an infusion technique and 10 studies using single infiltration). They concluded that local anesthetic wound infiltration decreasesd opioid consumption at 24 hour and pain scores after 24 hour at rest and on movement.[14]

In major abdominal surgery, epidural analgesia is often employed for post-operative pain relief.[15] This necessitates placement of indwelling catheters in epidural space to allow a continuous infusion of local anesthetic agents. Various studies have reported beneficial effects of epidural analgesia following major abdominal surgery.

A study was conducted by Block BM et al to evaluate the efficacy of post operative epidural analgesia vs parenteral opioids. It was observed that epidural analgesia, regardless of analgesic agent, location of catheter placement, and type and time of pain assessment, provided better post operative analgesia compared to parenteral opioids.[16]

The past decade has witnessed a significant shift towards regional analgesia as the primary technique in postoperative pain management. Single wound infiltration with local anesthetic (WI) or continuous local anesthetic infusion through catheters placed into the surgical wound (continuous wound infiltration, CWI) have recently been introduced as parts of multimodal analgesia for postoperative pain control following various surgical procedures under general or regional anesthesia.[17]

A study was performed by Li C et al in 2017 to evaluate the efficacy and safety of local infiltration anesthesia versus epidural analgesia for post op control in total knee arthroplasty. Primary end point was the VAS score at rest or mobilization at 12, 24 and 48, and 72 hour. Secondary outcome includes the range of motion, the length of stay and occurrence of nausea and vomiting.VAS scores at 12 and 24 hours were similar in patients receiving local infiltration analgesia orepidural analgesia. It was reported that local infiltration analgesia had equivalent efficacy as epidural analgesia in case of controlling pain with better, range of motion, reduced incidence of nausea and shortened length of hospital stay in patients receiving local infiltration analgesia.[18]

A study was conducted by Ventham NT et al for evaluating continuous local anesthetic wound infiltration with epidural analgesia for post operative pain following abdominal surgery. Total 505 patients were included in this study. Primary outcome was pain score at rest after 24 hour assessed using NRS. Secondary outcome include pain scores at rest at 48 hour and on movement at 24 hour and 48 hour. It was concluded that epidural analgesia reduced pain scores on movement and reduced opiate requirements.[19]

Many studies have been undertaken to compare the efficacy of 0.2% ropivacaine with other anesthetics agents for the management of post operative pain.

Saini D et al performed a study in 2018 to determine postoperative analgesic effect of ropivacaine in wound instillation for lumbar laminectomy. Forty patients scheduled for elective lumbar laminectomy under general anesthesia were enrolled and randomly allocated into two groups namely Group R (n=20 received 20ml of 0.25% ropivacaine) and Group N (n=20 received 20ml normal saline) as instillation over incision site. Post- operative pain score, duration of analgesia and total rescue analgesic required in 24 h were compared between the groups. The patients who received ropivacaine wound instillation had better pain control, longer duration of analgesia and less analgesic requirement as compared to patients who received normal saline wound instillation.[17]

A study by Mehta S et al aimed to compare postoperative epidural analgesia using 0.2% bupivacaine and 0.2% ropivacaine in major lower limb orthopedic surgery. 100 patients, aged 18–70 years, undergoing elective major lower limb orthopedic surgery under spinal anesthesia, were randomly allocated to receive either 7 ml ropivacaine 0.2% (Group R) or 7 ml bupivacaine 0.2% (Group B) for postoperative analgesia through a lumbar epidural catheter. The authors reported that 0.2% ropivacaine provided effective postoperative analgesia similar to

bupivacaine 0.2% with a distinct sensorymotor dissociation resulting in analgesia without motor blockade.[11]

In a retrospective study by Kunpeng Li et al; one hundred twelve patients undergoing lumbar fusion were reviewed and divided into two groups (ropivacaine and control groups). Visual Analogue Scale (VAS) score, analgesics consumption, number of patients requiring rescue analgesic, hospital duration and incidence of complications were recorded. The study showed that sufentanil consumption in ropivacaine group was lower at, 8, 12, 24, 48 and 72 h postoperatively ($P < 0.001$). Fewer patients required rescue analgesia within 4 to 8 h postoperatively in ropivacaine group (10/60 vs 19/52, $P = 0.017$). The duration of hospital stay was also shorter in patients receiving ropivacaine wound infiltration compared to control cohorts.[20]

Thus, a variety of studies have proved the beneficial effects of incision site infiltration of ropivacaine to reduce the post-operative opioid requirement. Similarly, epidural administration of local anesthetics is a time tested, safe and efficacious technique for management of post operative pain after major surgeries.

6.3 AIMS AND OBJECTIVES OF THE STUDY

To compare the efficacy of epidural infiltration of 10 ml of 0.2 % ropivacaine with sub-cutaneous wound infiltration of 10 ml 0.2 % ropivacaine for post operative pain relief following lumbar laminectomy in terms of:

- Rescue analgesic consumption in 24 hours
- Post operative pain scores as assessed by NRS

7. MATERIAL AND METHODS

7.1 SOURCE OF DATA

The study will be conducted in a prospective, randomized, double blinded manner in the department of Anesthesiology, DMCH, Ludhiana after obtaining clearance from hospital ethics committee. 60 patients of either gender between age group 18 to 65 years belonging to ASA grade I, II and III scheduled for elective lumbar laminectomy under general anesthesia will be randomly allocated to two groups of 30 patients each.

7.2 METHOD OF COLLECTION OF DATA

- **Inclusion Criterion**

Patients of either gender belonging to age group 18 to 65 years belonging with ASA grade I, II and III, scheduled for elective surgery under general anesthesia will be included in study.

- **Exclusion Criterion**
- Pregnant patients.
- History of previous spine surgery.
- Patients having a history of drug abuse, psychiatric disorders and inability to comprehend NRS.
- H/O allergy to local anesthetic agent
- **Pre-anesthetic check up**

A detailed pre-anesthetic check up will be conducted preoperatively one day prior to surgery comprising of detailed history, general physical and systemic examination. Patient will be counselled and explained regarding the surgical procedure and demonstrated the use of NRS.

Premedication

All patients will be kept nil per oral before surgery. This fasting period would be eight hours for solids and 2 hours for clear liquids. They would also be explained that they can request for analgesic whenever they experience pain. Pre-medication in the form of Tab Alprazolam 0.5 mg will be administered to all patients the night before surgery.

ANESTHESIA TECHNIQUE

Vitals will be monitored again in the pre-operative holding area. After arrival of patient to the operating room, standard monitoring such as electrocardiogram (ECG), non-invasive blood pressure (NIBP), heart rate (HR) and arterial oxygen saturation (SpO2) will be started and baseline parameters will be recorded. IV line will be secured using an 18 gauge cannula and I/V fluid will be infused. After standard anesthesia induction, using IV Propofol, patients will be paralyzed using InjAtracurium 0.5 mg/Kg and endotracheal intubation will be performed using appropriate endotracheal tube. Intra-operatively, anesthesia will be maintained using oxygen, nitrous oxide and desflurane. Intra-operative analgesia will be provided by bolus Injections of Fentanyl. Volatile agent concentration, muscle relaxant and analgesic administration will be titrated as per the discretion of anesthesiologist.

To avoid variation in surgical and anesthesia technique, all cases operated by the same team of neurosurgeon and anesthesiologist will be enrolled for the study.

Patients will be continuously monitored for the duration of surgery and vitals will be recorded every 5 minutes.

After the completion of surgery, patients will be administered study drug as per random group allocation.

Group A will be administered sub-cutaneous wound infiltration of 10ml of 0.2% ropivacaine just before applying subcutaneous sutures whereas, for Group B, 10ml of 0.2% ropivacaine will be instilled in the epidural space before surgical wound closure. The wound closure would begin after drug administration and wound would be closed in layers without suctioning or mopping.

All patients will be administered infusion of paracetamol 1 gm IV beginning with wound closure. At the end of procedure, residual neuromuscular blockade will be reversed with neostigmine 0.05 mg/kg and glycopyrrolate 0.01 mg/kg and ETT removed.

Post-operatively, patients will be shifted to the PACU, where they will be monitored by an anesthesiologist who would not be aware of the group allocation. Prophylaxis for post operative pain will be by administration of Inj Paracetamol 1 gm every 8 hourly.

In PACU, HR, NIBP, SpO2 and recording of NRS would be done every hourly for the initial 4 hours and after that every four hourly till the initial 24 hours. At any time, if patients complain of pain or if the NRS ≥ 4, Inj morphine 5mg IV will be administered and recorded. NRS at the time of morphine administration and total morphine consumption in the 24 hours will be recorded. The duration of analgesia will be defined as time interval from administration of study drug to requirement for first rescue analgesia. The degree of motor blockade if any would also be recorded using a modified Bromage score every hourly for the first 4 hours.

Any adverse event like nausea, vomiting, bradycardia (defined as heart rate less than 60 beats/min), respiratory depression (defined as respiratory rate < 8 breaths/min), hypotension (defined as fall in mean BP less below 20 % of baseline), will be recorded and treated as per PACU protocols. Patients will also be followed up for any wound hematoma, wound dehiscence or infection till the time of discharge.

Duration of Study/ Number of Cases

The study will be conducted in a prospective, randomized, double blinded manner in the department of Anesthesiology, DMCH, Ludhiana after obtaining clearance from hospital ethics committee. 60 patients of either gender between age group 18 to 65 years belonging to ASA grade I, II and III scheduled for elective lumbar laminectomy under general anesthesia will be randomly allocated to two groups of 30 patients each.

Group Allocation

Group Allocation

Patients will be randomly allocated into two groups, Group A and B, using computer generated random number list which will be kept in a sealed opaque envelope and opened at the completion of study. The study drugs

will be administered by the operating surgeon on completion of surgical procedure.

Group A - Patients will be administered sub-cutaneous wound infiltration of 10 ml 0.2% of ropivacaine.

Group B - Patients will be administered epidural instillation of 10 ml 0.2% ropivacaine.

The anesthesia resident monitoring the patient in post anesthesia care unit will not be aware of the group allocation and site of 0.2 % ropivacaine administration.

Outcome

The following parameters will be recorded and statistically analysed**:**

Primary: Total rescue analgesic consumption in 24 hours

Secondary: Post operative pain scores assessed by NRS.

Statistical Analysis

The objective of the study is to compare the analgesic consumption in patients

The formula used is as under:

$n = (\sigma 12 + \sigma 22) (Z\alpha + Z\beta)^2/(m1 – m2)^2$

Where,

Zα = Value of standard normal variate corresponding to α level of significance (1.96)

Zβ = The standard normal deviate for desired power (0.842)

m = Average

σ = Standard deviation

Assumptions:

From the Pilot study conducted,

Mean Group (m1) = 9

Mean Group (m2) = 12

Coefficient of variation = 150%

Standard deviation Group (σ1) = 3.7

Standard deviation (σ2) = 2.7

With the above assumptions the sample size for 95% confidence level & 90% power works out 25 in each group. This number has been increased to 30 per group (a total of 60) to allow for a predicted dropout from treatment.

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

No.

7.4 HAS ETHICAL CLEARANCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3?

Attached herewith.

8. LIST OF REFERENCES

1. Meissner W, Zaslansky R. A survey of postoperative pain treatments and unmet needs. Best Pract Res Clin Anesthesiol 2019;33:269- 86.

2.Roth RS, Qi J, Hamill JB, Kim HM, Ballard T, Pusic AL, et al. Is chronic postsurgical pain surgery-induced? A study of persistent postoperative pain following breast reconstruction. Breast (Edinburgh, Scotland). 2018;37:119-125

3. Overdevest GM, Jacobs W, Vleggeert-Lankamp C, Thomé C, Gunzburg R, Peul W. Effectiveness of posterior decompression techniques compared with conventional laminectomy for lumbar stenosis. Cochrane database of systematic reviews. 2015;24:2244–63.

4. O'Lynnger TM, Zuckerman SL, Morone PJ, Dewan MC, Vasquez-Castellanos RA, Cheng JS. Trends for spine surgery for the elderly: implications for access to healthcare in North America. Neurosurgery. 2015;77:S136-41.

5.Kurteva S, Abrahamowicz M, Gomes T, Tamblyn R. Association of opioid consumption profiles after hospitalization with risk of adverse health care events. JAMA network open. 2021;4:e218782.

6.M Dusica. Updates on Wound Infiltration Use for Postoperative Pain Management: A Narrative Review. J Clin Med 2021;10:4659-63.

7. Tsaousi G, Tsitsopoulos PP, Pourzitaki C, Palaska E, Badenes R, Bilotta F. Analgesic Efficacy and Safety of Local Infiltration Following Lumbar Decompression Surgery: A Systematic Review of Randomized Controlled Trials. Journal of Clinical Medicine. 2021;10:5936-9.

8. Wilson-Smith A, Chang N, Lu VM, Mobbs RJ, Fadhil M, Lloyd D, et al. Epidural steroids at closure after microdiscectomy/laminectomy for reduction of postoperative analgesia: systematic review and meta-analysis. World Neurosurgery. 2018;110:212-21.

9. Samagh N, Pai RK, Mathews TK, Jangra K, Varma RG. Pre-emptive caudal epidural analgesia with ropivacaine for lumbosacral spine surgery:

A randomized case control study. Journal of Anesthesiology, Clinical Pharmacology. 2018;34:237-41.
10.Kour L, Sharma N, Dogra D. Thoracic Epidural Analgesia for Lumbosacral Spine Surgery: A Randomized, Case-Control Study. Anesth Essays Res. 2021;15:119-25.
11.Mehta S, Gajbhare MN, Kamble NP. Superior post operative pain relief with thoracic epidural analgesia versus intravenous patient controlled analgesia after minimally invasive pectusexcavatum repair. Gen Thorac Surg. 2007;134:865-70.
12. Sullivan D, Lyons M, Montgomery R, Quinlan-Colwell A. Exploring opioid-sparing multimodal analgesia options in trauma: a nursing perspective. Journal of Trauma Nursing. 2016;23:361.
13. Xu B, Ren L, Tu W, Wu Z, Ai F, Zhou D, ET AL. Continuous wound infusion of ropivacaine for the control of pain after thoracolumbar spinal surgery: a randomized clinical trial. Eur Spine J. 2017;26:825-31.
14. Adesope O, Ituk U, Habib AS. Local anesthetic wound infiltration for postcaesarean section analgesia: A systematic review and meta-analysis. Eur J Anesthesiol. 2016;33:731-42.
15. Gavriilidis P, Roberts KJ, Sutcliffe RP. Local anesthetic infiltration via wound catheter versus epidural analgesia in open hepatectomy: a systematic review and meta-analysis of randomised controlled trials. HPB. 2019;21:945-52.
16. Block BM, Liu SS, RowlingsonAJ, Cowan AR, Cowan JA Jr, Wu CL. Efficacy of postoperative epidural analgesia: a meta-analysis. JAMA. 2003;290:2455-63.
17.Saini D, Yadav U. Study of Wound Instillation Technique for Effective Postoperative Analgesia using Ropivacaine in Lumbar Spine Surgery. J Anesthesia: essays and researches. 2018;12:1-5.
18. Li JW, Ma YS, Xiao LK. Postoperative Pain Management in Total Knee Arthroplasty.Orthop Surg. 2019;11:755-61.

19. Ventham NT, Hughes M, O'Neill S, Johns N, Brady RR, WigmoreSJ. Systematic review and meta-analysis of continuous local anesthetic wound infiltration versus epidural analgesia for postoperative pain following abdominal surgery. Br J Surg. 2013;100:1280-9.
20. Li K, Ji C, Luo D, Feng H, Yang K, Xu H. Wound infiltration with ropivacaine as an adjuvant to patient controlled analgesia for transforaminal lumbar interbody fusion: a retrospective study. BMC anesthesiology. 2020;20:1-7.

PROFORMA

S.NO.	MRD NO.
PATIENT INITIALS	RANDOMIZATION NO.
AGE/SEX	DIAGNOSIS
SURGERY PERFORMED	HEIGHT
WEIGHT	BMI
ASA GRADE	ANESTHESIA START: DATE/TIME
TIME OF ADMINISTRATION OF STUDY DRUG	SURGERY START: DATE/TIME
SURGERY FINISHED: DATE /TIME	ANESTHESIA FINISHED: DATE/TIME
DATE/TIME OF SHIFTING TO PACU	

POST OPERATIVE RECORD SHEET

	AFTER SHIFTING TO PACU TIME0	1 HOUR	2 HOUR	3 HOUR	4 HOUR	8 HOURS	12 HOURS	16 HOURS	20 HOURS	24 HOURS
HR										
SBP/ DBP										
MAP										
RR										
SPO2										
NRS										
RESCUE ANALGESIC ADMINISTERED										
MODIFIED BROMAGE SCORE										

Signature of Candidate **Signature of Supervisor**

ADVERSE EFFECTS

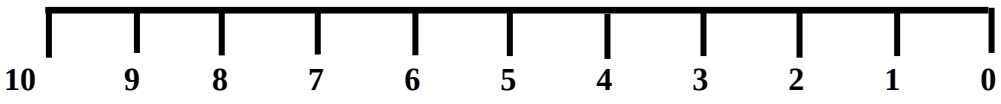
ADVERSE EFFECT	TIME OF ADVERSE EFFECT	NO. OF EPISODES	TREATMENT ADMINISTERED	
NAUSEA/VOMITING				
HYPOTENSION				
BRADYCARDIA				
RESPIRATORY DEPRESSION				
PRURITIS				
ANY OTHER				

TOTAL MORPHINE CONSUMPTION IN 24 HOURS	
WOUND HEMATOMA/ INFECTION(YES/NO)	

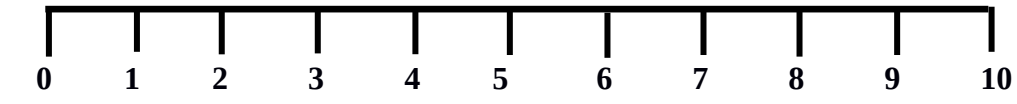
Modified Bromage score

0	PATIENT CAN MOVE THE HIP, KNEE AND ANKLE
1	PATIENT IS UNABLE TO MOVE THE HIP BUT IS ABLE TO MOVE KNEE AND ANKLE
2	PATIENT IS UNABLE TO MOVE HIPAND KNEE AND IS ABLE TO MOVE ANKLE
3	PATIENT IS UNABLE TO MOVE HIP, KNEE AND ANKLE

NUMERICAL RATING SCALE (PAIN SCALE)



Worst Pain — No Pain



No Pain — Worst Pain

Signature of Candidate **Signature of Supervisor**

INFORMED PATIENT CONSENT

Date: _____

I…….D/o, W/o, S/o……..…… am willing to participate in the study **"COMPARATIVE EVALUATION OF SURGICAL SITE WOUND INFILTRATION VERSUS EPIDURAL INSTILLATION OF 0.2% ROPIVACAINE FOLLOWING LUMBAR LAMINECTOMY"** The procedure with its complications has been explained to me in local vernacular language. I have fully understood that no special tests and extra expenditure in any form, merely for the purpose of thesis is being carried out. I am free to opt out the study any time without assigning any reason.

……. ……
Signature of the Witness Signature of the patient

Name:

Signature of Candidate **Signature of Supervisor**

मरीज अनुमति फार्म

तिथि _____

मैं _____ पत्नी/पुत्र/पुत्री _____

निवासी _____

इस शोधकार्य "**COMPARATIVE EVALUATION OF SURGICAL SITE WOUND INFILTRATION VERSUS EPIDURAL INSTILLATION OF 0.2% ROPIVACAINE FOLLOWING LUMBAR LAMINECTOMY**" में भाग लेने के लिए सहमत हूँ। मैं इस शोधकार्य में भाग लेने के लिए अपनी स्वेच्छा से तैयार हूँ। मैं पुष्टि करता/करती हूँ की यह स्वीकृति देने के लिए मुझे कोई आर्थिक प्रलोभन नहीं दिया गया और न ही दबाव डाला गया है। मुझे इस शोधकार्य का उद्देश्य स्पष्ट कर दिया गया है और मुझे यह विश्वास है की यह विज्ञान और मानवता के लाभ के लिए है। मुझे इस शोधकार्य में होने वाले जोखिम के बारे में समझा दिया गया है और मेरी समझ में यह जोखिम बहुत मामुली है।

मैं इस शोधकार्य में भाग लेने के सम्बन्ध में किसी भी समय अपनी अस्वीकृति व्यक्त कर सकता/सकती हूँ और मेरे अस्वीकृति व्यक्त करने का मेरे इलाज पर कोई प्रभाव नहीं पड़ेगा।

_____ _____

गवाह के हस्ताक्षर रोगी के हस्ताक्षर/अंगूठे का निशान

नाम: नाम:

_____

अन्वेषक के हस्ताक्षर

_____

विद्यार्थी के हस्ताक्षर

ਮਰੀਜ਼ ਰਜ਼ਾਮੰਦੀ ਫਾਰਮ

ਮਿਤੀ_____

ਮੈ_____ਪਤਨੀ/ਪੁੱਤਰ/ਪੁੱਤਰੀ_____

ਵਾਸੀ _____

“COMPARATIVE EVALUATION OF SURGICAL SITE WOUND INFILTRATION VERSUS EPIDURAL INSTILLATION OF 0.2% ROPIVACAINE FOLLOWING LUMBAR LAMINECTOMY” ਤੇ ਚਲ ਰਹੀ ਖੋਜ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਰਜ਼ਾਮੰਦ ਹਾਂ। ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਮੈ ਆਪਣੀ ਮਰਜ਼ੀ ਨਾਲ ਤਿਆਰ ਹਾਂ। ਮੈ ਇਹ ਦਸਣਾ ਚਾਹੁੰਦਾ ਹਾਂ/ ਚਾਹੁੰਦੀ ਹਾਂ ਕੇ ਇਹ ਰਜ਼ਾਮੰਦੀ ਦੇਣ ਵਾਸਤੇ ਮੈਨੂ ਕਿਸੇ ਵੀ ਤਰਾਂ ਦਾ ਲੋਭ-ਲਾਲਚ ਨਹੀ ਦਿੱਤਾ ਗਿਆ ਅਤੇ ਨਾ ਹੀ ਕੋਈ ਦਬਾ ਪਾਇਆ ਗਿਆ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਦਾ ਮਨੋਰਥ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਭਰੋਸਾ ਦਵਾਇਆ ਗਿਆ ਹੈ ਕੇ ਇਹ ਖੋਜ ਵਿਗਿਆਨ ਅਤੇ ਮਾਨਵਤਾ ਦੀ ਭਲਾਈ ਲਈ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਵਿਚ ਹੋਣ ਵਾਲੇ ਖਤਰੇ ਬਾਰੇ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਯਕੀਨ ਹੈ ਕੇ ਇਹ ਖਤਰਾ ਬਹੁਤ ਮਾਮੂਲੀ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਦਾ ਢੰਗ – ਤਰੀਕਾ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ।

ਮੈ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਬਾਰੇ ਆਪਣੀ ਰਜ਼ਾਮੰਦੀ ਕਿਸੇ ਵੀ ਸਮੇ ਵਾਪਸ ਲੈ ਸਕਦਾ ਹਾਂ/ ਸਕਦੀ ਹਾਂ ਅਤੇ ਮੇਰੀ ਰਜ਼ਾਮੰਦੀ ਵਾਪਸ ਲੈਣ ਦਾ ਮੇਰੇ ਇਲਾਜ ਤੇ ਕੋਈ ਅਸਰ ਨਹੀ ਹੋਵੇਗਾ।

_____ _____

ਗਵਾਹ ਦੇ ਹਸਤਾਖਰ ਮਰੀਜ਼ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ_____ ਮਿਤੀ_____

ਪਤਾ _____ ਪਤਾ _____

_____

ਨਿਰੀਖਕ ਦੇ ਹਸਤਾਖਰ

_____

ਸਿਖਿਆਰਥੀ ਦੇ ਹਸਤਾਖਰ